Sterigenics Willowbrook Facility - Updates

Related Information

- Sterigenics Willowbrook Facility home page

Scroll through the items listed below to read updates related to Sterigenics and ethylene oxide air concentrations in Willowbrook, IL. The most recent updates are posted at the top of the page.

August 14, 2019

The U.S. Environmental Protection Agency (EPA) posted the Risk Assessment Report for the Sterigenics Facility in Willowbrook, IL The report and associated appendices can be found here.

May 29, 2019

The U.S. Environmental Protection Agency (EPA) posted a summary of the agency's risk assessment of ethylene oxide emissions from the Sterigenic's Commercial Sterilizer in Willowbrook, Illinois. Read the summary here.

Presentations from the Community Meeting held on May 29 can be downloaded here.

May 20, 2019

The U S Environmental Protection Agency (EPA) held an Air Toxics Risk Assessment 101 on Monday, May 20, 2019 to provide information about how the Agency assesses risk from air toxic pollutants in the outdoor air

Slides from the May 20th webinar are available here.

Watch a recording of the webinar here

May 13, 2019

The U.S. EPA will host an open house and community meeting to provide updates on the agency's work to better understand air emissions of ethylene oxide from the Sterigenics facility in Willowbrook, Illinois. Both will be held Wednesday, May 29, 2019 at the Marriott Chicago Southwest at Burr Ridge, 1200 Burr Ridge Parkway, Burr Ridge, Illinois, 60527.

April 26, 2019

The U.S. Environmental Protection Agency held a webinar on Wednesday, April 26, 2019 to review the final set of ethylene oxide air monitoring data in the Willowbrook, IL area.

Slides from the April 26th webinar are available here.

Watch a recording of the webinar here.

April 24, 2019

The U.S. Environmental Protection Agency held a webinar on Wednesday, April 24, 2019 to review Techniques and Skills for Providing Effective Input in the EPA Rulemaking Process.

Slides from the April 24th webinar are available here.

Watch a recording of the webinar here.

April 17, 2019

A recording of the April 9, 2019 webinar "Air Toxics 101 for Ethylene Oxide" is available here.

April 10, 2019

A recording of the March 21, 2019 webinar "Update of EPA's Ethylene Oxide Monitoring data for Willowbrook, Illinois" is available here.

March 28, 2019

EPA to Pause Monitoring

After 4 ½ months of testing the community's air for ethylene oxide, EPA will pause air quality monitoring in Willowbrook, Illinois at the end of the month. The Agency is evaluating options -- including whether to resume monitoring – if conditions in the community change.

Based on feedback from the community, EPA began monitoring in Willowbrook in November 2018, seeking three-months of air quality monitoring data to help the agency assess risks from ethylene oxide emissions from the Sterigenics commercial sterilizer in Willowbrook. EPA has begun work on its risk assessment, which the Agency expects to complete later this Spring.

March 22, 2019

A recording of the March 7, 2019 webinar, "Update of EPA's Ethylene Oxide Monitoring data for Willowbrook, Illinois" is available here.

March 21, 2019

Latest monitoring data posted:

EPA has posted results for 7 days of air quality monitoring in Willowbrook February 14, 19, 20, 21, 22,23, and 26, 2019.

EPA webinar: Update of EPA's Ethylene Oxide Monitoring data for Willowbrook, Illinois

The U S Environmental Protection Agency held a webinar at **2 p.m. central time, Thursday, March 21, 2019**, to review data from air quality monitoring in Willowbrook, Illinois conducted between February 14 and February 26, 2019

Slides from the March 21st webinar are available here.

Watch a recording of the webinar here

March 7, 2019

The U.S. Environmental Protection Agency held a webinar at 2 p.m. CST Thursday, March 7, 2019 to review air quality monitoring data for Willowbrook, Illinois, covering seven days from January 22, 2019 to February 11, 2019.

Slides from the March 7th webinar are available here.

Watch a recording of the webinar here.

February 21, 2019

The U.S. Environmental Protection Agency held a webinar at 1 p.m. CST Thursday, February 21, 2019 to review air quality monitoring data for Willowbrook, Illinois, covering seven days from January 2, 2019 to January 17, 2019.

Slides from the February 21st webinar are available here.

Watch a recording of the webinar here.

February 5, 2019

Results for air quality samples taken in late November and December 2018:

EPA has posted results for 12 days of air quality monitoring in Willowbrook: November 25 and 28, and December 1, 6, 7, 10, 13, 16, 19, 22, 26 and 28 EPA will use all the data as part of a full assessment of risk from ethylene oxide in Willowbrook, which we expect to complete by Spring 2019

With these results, seven weeks of data are now available. Based on the full data set to date, EPA notes:

- The two sites located closest to the two Sterigenics buildings are seeing the highest ethylene oxide concentrations. Average readings are a little over 2 micrograms per cubic meter; however, there have been readings as high as 10 and 11 micrograms per cubic meter.
- Monitors at the six community-oriented sites are seeing ethylene oxide concentrations that are consistently on the order of a few tenths of a microgram per cubic meter.
  - At community-oriented monitors *upwind* of the Sterigenics buildings, ethylene oxide concentrations generally have ranged from 0.1 to 0.5 micrograms per cubic meter.
  - At the community-oriented monitors *downwind* of the Sterigenics buildings, ethylene oxide concentrations have occasionally been as high as 1.7 micrograms per cubic meter.
- Despite the additional data, monitoring information about ethylene oxide in the Willowbrook area remains limited. It remains premature to draw conclusions about long-term health risks from the data. EPA is continuing to monitor in the Willowbrook area and will continue to post data as it becomes available. We expect to post data from several January sampling days soon.
- EPA will use all the data as part of a full assessment of risk from ethylene oxide in Willowbrook, which we expect to complete by Spring 2019.
- Note: as part of EPA's ongoing quality assurance efforts, the agency has updated a few results from November. These updates apply to a small number of lower concentration values; they do not change any of the higher values.

EPA webinar: Update of EPA's Ethylene Oxide Monitoring data for Willowbrook, Illinois:

The U.S. Environmental Protection Agency held a webinar at 1 p.m. Central Time Tuesday, February 5, 2019 to review the most recent air quality monitoring data for Willowbrook, Illinois.

Slides from the February 5th webinar are available here.

Watch a recording of the webinar here.

January 28, 2019

Status of ethylene oxide monitoring data

EPA is completing steps to assure the quality of air quality samples taken in the Willowbrook community in December 2018, as well as during the government shutdown in January 2019. We will post results as soon as possible.

December 28, 2018

New questions and answers were added to the Frequent Questions page on December 20 and 28th.

December 13, 2018

The U.S. Environmental Protection Agency will hold a webinar Tuesday, December 18, 2018, to provide updates on ethylene oxide monitoring in Willowbrook, Ill.

Slides from the December 18th webinar are available here.

Watch a recording of the webinar here.

December 7, 2018

EPA has posted results for three days of air quality monitoring in Willowbrook: November 13, 16 and 19

- Monitors detected ethylene oxide in the air at the two sites closest to the Sterigenics facility.
- Monitors did not detect ethylene oxide at the six community-oriented sites -- those at schools and in residential areas.
- It is premature to draw conclusions from the data. EPA plans to continue monitoring in the Willowbrook area for three months and will continue to post data as it becomes available.
- EPA will conduct a full assessment of risk from ethylene oxide in Willowbrook, which we expect to complete by Spring 2019.
- On November 21, 2018, EPA announced that it had identified an issue with the analytical method used in previous EPA monitoring. We have changed the analytical method, so that the issue does not affect these results.

Learn more about the monitoring and see the data by location.

November 23, 2018

Background information packet on ethylene oxide for the Willowbrook Community

November 21, 2018

- **Open House and Public Meeting on Ethylene Oxide**
  The U.S. EPA will host an open house and community forum to provide updates on the agency's work to better understand air emissions of ethylene oxide from the Sterigenics facility in Willowbrook, Illinois. Both will be held Thursday, November 29, 2018 at Ashton Place, 341 75th St, Willowbrook, Ill.

- **Potential Issue Regarding Previous Ethylene Oxide Monitoring Results**
  U.S. EPA recently discovered an issue with the way ethylene oxide has

been measured As a result of the issue, monitors may have reported higher ambient levels of ethylene oxide than actually exist. More specifically, the chemical Trans 2 butene can be incorrectly identified as ethylene oxide when air quality samples are being analyzed in a laboratory. Trans-2-butene can be released from petrochemical industrial processes and the burning of fossil fuels. EPA discovered the issue as part of its work to improve the analysis method for ethylene oxide

- **What this Means**
  This discovery means that the results of air quality monitoring conducted prior to October 2018 may have shown higher concentrations of ethylene oxide than were actually in the air. This includes air quality monitoring that U S EPA's Region 5 conducted in mid-May 2018 in Willowbrook, Illinois. U.S. EPA cannot fully evaluate the difference between reported and actual ethylene oxide concentrations, as the samples of air collected in mid-May are no longer available for analysis U S EPA has made a change to its analytical method to prevent this issue in the analysis of future air quality samples including those from monitoring started in November 2018 in the Willowbrook area. U.S. EPA is making the technical information about this change available for other laboratories.

- **Does the monitoring issue change EPA's conclusions in the National Air Toxics Assessment (NATA)?**

  No. U.S. EPA would have been concerned about ethylene oxide in Willowbrook, even without air quality monitoring– U S EPA's NATA identified census tracts in the Willowbrook area as a potentially higher risk community NATA is based on air quality modeling it does not rely on any air monitoring data.

  In addition, in the health consultation conducted for U.S. EPA Region 5, ATSDR relied on both the Region's *modeled* estimates of ethylene oxide in the outdoor air in the area near the Sterigenics facility as well as the results of the monitoring the Region conducted in mid-May.

November 14, 2018

EPA is monitoring the outdoor air near the Sterigenics facility to better understand levels of ethylene oxide (EtO) in the air. The first monitors began collecting air samples on November 13, 2018. Learn more.

November 5, 2018

EPA will hold a community meeting on November 29, 2018 We will post more information once we finalize time and location.

October 24, 2018

EPA has set up a dedicated email address for inquiries related to ethylene oxide and the Sterigenics facility in Willowbrook, IL. Emails should be sent to EtO@epa.gov.

October 10, 2018

What is EPA doing to reduce ethylene oxide from the Sterigenics facility?

***What has been done to date*:**

Sterigenics has taken steps to further control ethylene oxide emissions from the Willowbrook facility and estimates that those controls have reduced ethylene oxide by about 92 percent.

On September 20 and 21, 2018, a contractor hired by Sterigenics conducted stack tests to measure the actual emissions from the control devices at the facility. U.S. EPA and Illinois EPA experts were present to observe the tests.

The following links exit the site EXIT

See the test results from September 20, 2018 and September 21, 2018.

What happens next:

- Once the final report from the stack test is complete, and delivered to U. S. EPA, the Agency will review the results to confirm how much ethylene oxide the pollution controls are reducing. EPA will that information to estimate *current* emissions from the Sterigenics facility.
- U.S. EPA needs the emissions estimates to help the agency determine how far any remaining ethylene oxide emissions will disperse and what the levels of ethylene oxide in the air nearby the facility are likely to be. EPA will determine this using a computer model.
- The information also will help EPA determine the best places to monitor the air for ethylene oxide in the area. EPA will work with local elected officials in the area as it develops its monitoring plan.
- Existing monitoring methods are not sensitive enough to detect ethylene oxide at all levels in the outdoor air. Because of this, EPA cannot use monitoring alone to determine the levels of ethylene oxide in the air around the facility.
- EPA will conduct a risk assessment for the Willowbrook area. This assessment will be more comprehensive than either NATA or the ATSDR analysis. It will be similar to the types of risk assessments EPA conducts when it is reviewing its regulations for industries that emit air toxics to determine whether those rules need to be updated to improve protection of public health.
- EPA will update this information as this work proceeds on our website at: https://www.epa.gov/il/sterigenics-willowbrook-facility

LAST UPDATED ON JANUARY 27, 2020

Questions and Answers: Emissions at Sterigenics

Emissions at Sterigenics

See additional categories of questions and answers.

I would like to know the specifics of the test equipment make, model, specifications?

The emissions source testing equipment includes

- SRI Model 8610 Portable GC
- Dual Sample Loops /Dual Injector/Dual Column/Dual Detector

- Outlet 2 cc sample loop/ 6' packed column 1% SP 1000 on 60/80 Carbopack B/ 11.7 eV Photoionization Detector (PID).
- Inlet 2 cc sample loop/ 6' packed column 1% SP 1000 on 60/80 Carbopack B/ Flame Ionization Detector (FID).
- This information can also be found in Section 5 of the test reports available on the Illinois EPA website.
  - https //www2 illinois gov/epa/topics/community_relations/sites/sterigenics/Documents/WBI%20rev1.pdf
  - https //www2 illinois gov/epa/topics/community_relations/sites/sterigenics/Documents/WBII%20rev.1.pdf

Is there a time of day that is the worst time, higher emissions than normal, that one would be exposed to emissions from Sterigenics?

When the weather is calm and clear, specifically during the nighttime, temperature inversions may occur. Temperature inversion occurs when cold air close to the ground is trapped by a layer of warmer air As the inversion continues, air becomes stagnant and pollution may become trapped close to the ground

Is Sterigenics required to self-report data?

The Clean Air Act does not require mandatory reporting of emissions for air toxics, like ethylene oxide. As such, when EPA conducts its national air toxics assessment, it relies primarily on air toxics data that state air agencies voluntarily report to EPA for the National Emissions Inventory (NEI). The agency also considers air toxics information that facilities are required to report to the Toxics Release Inventory (TRI), which was created under the Emergency Planning and Community Right to Know Act (EPCRA)

EPA is currently reviewing the reporting of ethylene oxide to the TRI Program.

It looks like the amount of EtO used at Sterigenics was higher in prior years. Does that mean that the risk was higher in prior years?

The National Air Toxics Assessment (NATA) provides risk estimates that are a "snapshot" in time. EPA's most recent NATA is based on emissions data from 2014 We do not have sufficient information to characterize risks for prior years For example, even though EPA conducted NATAs for prior years (1996, 1999, 2002, 2005, and 2011), it's not meaningful and sometimes misleading to compare these assessments to the 2014 NATA, because we have improved the NATA source inventory, made modeling changes, revised background calculations, and updated some health benchmarks. The lack of detailed emissions information for prior years is a significant limitation in the ability to assess past risks. But we do know that current emissions have changed since 2014 in light of the additional controls put in place in July 2018 We are in the process of gathering the detailed emissions information we need to provide a more certain and refined risk assessment for people in Willowbrook

Why is Sterigenics allowed to self-report their annual emissions when the EPA's own people estimate emissions that are 5 8.5% higher than the numbers reported by Sterigenics?

The Clean Air Act does not require mandatory reporting of emissions for air toxics, like ethylene oxide. As such, when EPA conducts its national air toxics assessment, it relies primarily on air toxics data that state air agencies voluntarily report to EPA for the National Emissions Inventory (NEI). The agency also considers air toxics information that facilities are required to report to the Toxics Release Inventory (TRI), which was created under the Emergency Planning and Community Right to Know Act (EPCRA)

For their NEI reports, a state may have received different facility-provided values compared to those reported to the TRI, performed additional emission calculations, or made revisions to certain data.

A facility will trigger TRI reporting requirements if it (1) is in a TRI covered industry sector; (2) has 10 or more full-time employees; and (3) manufactures, processes, or otherwise uses more than the listed threshold amount of a TRI listed chemical during a reporting year. Ethylene oxide sterilizers, like Sterigenics, fall under "product sterilization and packaging services" (NAICS Code 561910), which is not a TRI-covered industry sector. Although Sterigenics did report emissions to TRI in years past, they stopped reporting in 2017

The Willowbrook task force has asked the EPA three times for more testing at Sterigenics specifically to test while they are running all chambers, back vent emissions and fugitive emissions. They have not been responded to at all with this request.

In September 2018, Sterigenics conducted stack tests pursuant to a requirement in their construction permit, which was issued by the Illinois EPA in June 2018 (see Special Condition 6 of Application Number 18060020). Testing was performed according to the test protocol approved by the Illinois EPA The purpose of the test was to demonstrate the effectiveness of the pollution controls to remove the ethylene oxide from the chamber exhaust vent cycle (also called the backvent) at conditions that should have represented the highest amount of ethylene oxide through the chamber exhaust vents (see Section 3 0 of Test Protocol Addendum) U.S. EPA will consult with the Illinois EPA on whether the Illinois EPA, in their capacity as the permitting authority, will require further stack tests for the purpose of determining compliance with the applicable permit conditions.

Is the third party conducting the testing owned by Sterigenics or a financial connection?

ECSI LLC is the testing company hired by Sterigenics to conduct the September stack testing at the facility. There is no indication this company has a financial connection to Sterigenics Illinois EPA and USEPA were on site to be sure the tests were conducted correctly.

Are all discharges of EtO connected to scrubbers at the Sterigenics facility? These would include the main vent when EtO is pumped out of the sterilization chamber at the end of a cycle, any back vents during the purging of the chamber and vents?

There are two exhaust streams that are required to be controlled the aeration room vent and the chamber vent. These are connected to control devices. The backvent emissions also are now controlled (though not required) This control measure doesn't include fugitive emissions – those that leak out of a door or vents, for example

What has changed to make emission controls on the back vents suddenly feasible? The EPA and industry removed the rule about controlling back vents after it was determined it was too dangerous (risk of explosion)?

The EPA rule for commercial sterilizers, like Sterigenics, was adopted in November 1994. That rule required either a maximum concentration limit or 99% control, depending on the facility ethylene oxide usage. In July 1997, EPA learned of explosions that were occurring at several facilities due to oxidizers being overfed with ethylene oxide. This was determined to be caused by abnormal activity coming from back vents. At the time, industry and EPA concluded that were no safety mechanisms available to regulate the flow of EO from back vents into control devices, and the backvent requirement was subsequently removed from the rule in November 2001. In April 2006, EPA reviewed and retained the 1994 rule (as amended), which did not require back vent control. At the time the rule was adopted in 1994 (and subsequently reviewed in 2006), our understanding of the risk of ethylene oxide was not what it is today. We have now begun the work to re-review that rule, but the regulation development will take time.

LAST UPDATED ON AUGUST 18, 2020

Evaluation of EPA Actions to Address Elevated Cancer Risks from Air Toxics Emissions from Point Sources
OA&E-FY19-0091
WP A.16.a

PURPOSE: To summarize the dissemination of the instruction/directive to Region 5 Air and Radiation Division not to conduct inspections at ethylene oxide-emitting facilities unless invited by a state to conduct a joint inspection.

SCOPE: Reviewed WPs from Assignment Guide H and other information to summarize the dissemination of the instruction/directive to Region 5 Air and Radiation Division not to conduct inspections at ethylene oxide-emitting facilities unless invited by a state to conduct a joint inspection.

SOURCE: A) OAR organizational chart (https://www.epa.gov/aboutepa/organization-chart-epas-office-air-and-radiation, accessed 1/25/21)

B) OAR offices and their leadership (https://www.epa.gov/aboutepa/about-office-air-and-radiation-oar#oaqps, accessed 1/25/21)

C) Clint Woods being a political appointee (https://www.eenews.net/stories/1061827363, accessed 1/27/21)

D) Bill Wehrum being a political appointee (https://thehill.com/policy/energy-environment/478831-oversight-finds-epa-political-appointees-slow-walked-ethics, accessed 1/27/21)

E) 1/29/21 email from Katie Siegel confirming Cathy Stepp and Kurt Thiede were political appointees.

F) Assignment Guide H WPs

CONCLUSION: Clint Woods (the then-Deputy Assistant Administrator for Air and Radiation) disseminated the instruction/directive that the Region 5 Air and Radiation Division not conduct inspections at ethylene oxide-emitting facilities unless invited by a state to conduct a joint inspection to Mike Koerber of OAQPS who then disseminated to the Region 5 Air and Radiation Division. (b) (5) [redacted] Clint Woods was a political appointee. Due to his high-level position, we refer to him as a senior political appointee. (also see Source C)

DETAILS:

Prepared by:	Date
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Approved by:	**Date**
Julie Narimatsu	1/30/21

Based on a review of Assignment Guide H WPs, there was an instruction/directive from Clint Woods (the then-Deputy Assistant Administrator for Air and Radiation) to the Region 5 Air and Radiation Division not to conduct any inspections at ethylene oxide-emitting facilities unless the state invites the region to conduct a joint inspection. (b) (5) [redacted]

A Link: Link: **Figure 1:** (b) (5) [redacted]

(b) (5) [redacted]

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(b) (5) [redacted]

Table 1: Support for the Inspection Instruction/Directive and Dissemination Routes

Route Number	Interviews	Emails	Evaluator notes
1a	(b) (5), (b) (6) [redacted] said Clint wants to keep this to regulatory plus voluntary controls and not use enforcement tools. He was ok with inspections if the state requested it - as in, accompany them - which we did in Michigan." (b) (5) [redacted]	On 10/15/18, (b) [redacted] updated the Chief of Staff and Acting Deputy RA, explaining that Clint Woods was okay with Region 5 participating in the joint inspections as long as the region was invited by state or local agencies. (b) (5) [redacted]	(b) (5) [redacted]
1b	(b) (5), (b) (6) [redacted] HQ allowed Region 5 to conduct inspections if a state invited Region 5 to tag along a state inspection and Region 5 could provide needed assistance or equipment, such as leak detection equipment. (b) (5) [redacted]	None.	(b) (5) [redacted]

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2	(b) (5), (b) (6) [redacted] OAQPS who said that Region 5 may not conduct inspections of ethylene oxide-emitting facilities unless the region had been invited by a state to conduct a joint inspection and the region has equipment to help with the inspection. This directive to not conduct inspections may be because (b) (5) [redacted]	None	(b) (5) [redacted]
C Link: 3	(b) (5), (b) (6) [redacted] Region 5 management also told staff not to issue CAA Section 114 letters to ethylene oxide-emitting facilities, not to conduct inspections at ethylene oxide emissions, not to conduct ambient monitoring at ethylene oxide-emitting facilities, and not to conduct modeling of ethylene oxide emissions from stationary sources. Region 5 would have to obtain approval from HQ or OAQPS to do any of these (b) (5), (b) (6) [redacted]	None.	(b) (5) [redacted]

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D Link: 4	(b) (5), (b) (6) [redacted]	None.	(b) (5) [redacted]
5		(b) (5) [redacted]	(b) (5) [redacted]

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			(b) (5) [redacted]
6		(b) (5) [redacted] thanking them for their assistance with that day's conference call. Cook County then requested Region 5's presence for a joint inspection. (H.02.d > Source U > Pg. 4 of 4)	(b) (5) [redacted]

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			(b) (5) [redacted]
7	(b) (5), (b) (6) [redacted]		(b) (5) [redacted]

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8	(b) (5), (b) (6) [redacted]		(b) (5) [redacted]
Did not ask interviewee from whom she heard about the directive.	(b) (5), (b) (6) [redacted] [redacted].		Evaluator believes (b) (5) [redacted]

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	(b) (6), (b) (5) [redacted]		

E Link: WP M.07.b.3 - Indexed Congressional Request Draft Report - Chapter 3.docx As shown in Figure 1 and Table 1, in September 2018, a Region 5 manager (b) (5), [redacted] asked an OAQPS manager ((b) (6) [redacted]) whether the Region could conduct inspections at ethylene oxide-emitting facilities. According to Region 5, the OAQPS manager (b) (6) [redacted]) asked the then-deputy assistant administrator for Air and Radiation (Clint Woods) (Evaluator conclusion based on Table 1 > columns "Interviews" and "Evaluator notes" > Routes 1a. The dissemination of the instruction/directive was in September 2018 given that Michigan requested Region 5's presence (b) (5) [redacted] – See Table 1 > columns "Emails" and "Evaluator notes" > Route 5) and then orally relayed instructions to two Region 5 managers not to conduct any inspections at ethylene oxide-emitting facilities unless invited by the state. (Evaluator conclusion based on Table 1 > columns "Interviews" and "Evaluator notes" > Routes 1a and 2)

The Region 5 manager orally relayed this information to other Region 5 managers, (Table 1 > columns "Interviews" and "Evaluator notes" > Routes 3 and 4) who would not allow their inspectors to inspect ethylene oxide-emitting facilities. (Table 1 > column "Evaluator notes" > Route 4) According to a Region 5 personnel, OAQPS personnel had directed Region 5 not to conduct inspections at ethylene oxide facilities because it did not follow EPA headquarters two-pronged approach, which included reviewing regulations pertaining to facilities that emit ethylene oxide and collecting (b) (5) [redacted] information from facilities. (H.03.a > Details section > subsection "Directive not do inspections at EtO facilities" > paragraph that begins "Ed: We have multiple tools....")

According to emails provided by Region 5, Region 5 personnel orally communicated the instructions to state and local agencies. Within one day of Region 5 personnel relaying this information to one state and one local agency, these agencies emailed Region 5 requesting the Region's presence and assistance with on-site inspections at ethylene oxide-emitting facilities. (H.02.d > Source U > Pg. 1 and 4 of 4) because of the Region's expertise and ownership of specialized equipment, such as a leak detector, that some state and local agencies did not have. (Evaluator conclusion based on H.03.a > Source A > Pg. 1 of 2 > 1st paragraph > last sentence (b) (5) [redacted]

Figure 2 below is a summary of Figure 1 as it shows where within OAR was the inspection instruction/directive was flowing from to get to Region 5 ARD.

B Link: Link: Link: **Figure 2: Dissemination of the inspection instruction from OAR to Region 5 (see red line)**

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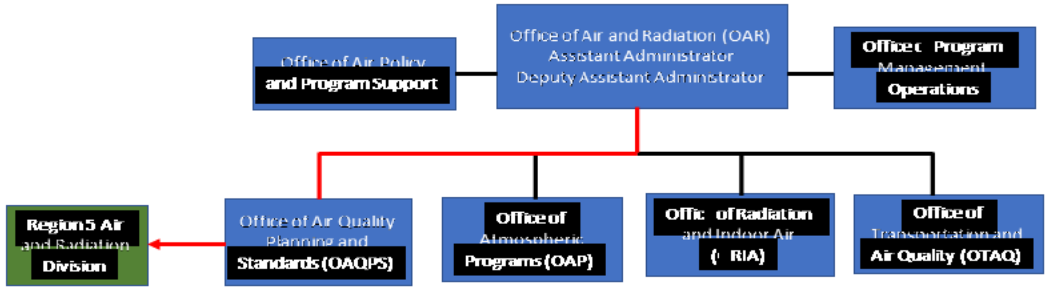

Source: Information from the EPA (EPA OIG image) [Evaluator note: The figure shows the dissemination of the inspection directive or instruction from OAR to Region 5 (see red line). The figure includes the organizational chart for OAR, which comes from Source A. (b) (5) [redacted] Source C shows Clint Woods being a political appointee.

Reviewer Comment (and Date of Review)	Team Response (and Date of Response)	Resolution (and Date of Resolution)
(b) (5) [redacted]	(b) (5) [redacted]. BC, 1/29/21	Point cleared. Thx. JN 1/30/21
(b) (5) [redacted]	(b) (5) [redacted] BC, 1/29/21	Ok, thanks. JN 1/30/21
(b) (5) [redacted]	(b) (5) [redacted]	Ok, thanks. JN 1/30/21

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(b) (5) [redacted]	(b) (5) [redacted] BC, 1/29/21	
(b) (5) [redacted]	(b) (5) [redacted] BC, 1/29/21	Source E actually has all the information needed here – it just isn't used as an index anywhere. I have added where necessary. Point cleared. JN 1/30/21
(b) (5) [redacted]	(b) (5) [redacted] BC, 1/29/21	Point cleared. JN 1/30/21
(b) (5) [redacted]	(b) (5) [redacted] BC, 1/29/21	Point cleared. JN 1/30/21

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Organization Chart for EPA's Office of Air and Radiation

Office of Air Policy and Program Support

Office of Air and Radiation (OAR) Assistant Administrator and Deputy Assistant Administrator

202-564-7404
About OAR

Office of Program Management Operations

Office of Air Quality Planning and Standards (OAQPS)

919 541 5616
About OAQPS

- Policy Analysis and Communications Staff
- Central Operations and Resources
- Air Quality Assessment Division
- Air Quality Policy Division
- Health and Environmental Impacts Division
- Outreach and Information Division
- Sector Policies and Programs Division
- Washington Operations Staff

Office of Atmospheric Programs (OAP)

202-343-9140
About OAP

- Clean Air Markets Division
- Climate Protection Partnership Division
- Stratospheric Protection Division
- Climate Change Division

Office of Transportation and Air Quality (OTAQ)

202-566-0495
About OTAQ

- Assessment and Standards Division
- Compliance Division
- Transportation and Climate Division
- Testing and Advanced Technology Division

Office of Radiation and Indoor Air (ORIA)

202 343 9320
About ORIA

- Program Management Office
- Indoor Environments Division
- Radiation Protection Division
- Radiation and Indoor Environments National Laboratory
- National Analytical Radiation Environmental Laboratory

LAST UPDATED ON OCTOBER 24, 2017

An official website of the United States government

About the Office of Air and Radiation (OAR)

Related Information

- Contact OAR
- Organization chart
- Your Air Quality
- Your UV Index
- National Analytical Radiation Environmental Laboratory
- National Vehicle and Fuel Emissions Laboratory
- National Center for Radiation Field Operations

OAR Press Releases

- All news releases

What We Do

The Office of Air and Radiation (OAR) develops national programs, policies, and regulations for controlling air pollution and radiation exposure. OAR is concerned with:

- pollution prevention and energy efficiency,
- indoor and outdoor air quality,
- industrial air pollution,
- pollution from vehicles and engines,
- radon,
- acid rain,
- stratospheric ozone depletion,
- climate change, and
- radiation protection.

OAR is responsible for administering the Clean Air Act, the Atomic Energy Act, the Waste Isolation Pilot Plant Land Withdrawal Act, and other applicable environmental laws

Organization

Vacant, Principal Deputy Assistant Administrator

Elizabeth Shaw, Deputy Assistant Administrator

- Phone: (202) 564-7400

The Office of Air and Radiation includes:

- Office of Air Quality Planning and Standards
- Office of Atmospheric Programs
- Office of Transportation and Air Quality
- Office of Radiation and Indoor Air

Office of Air Quality Planning and Standards (OAQPS)

What We Do

OAQPS's primary mission is to preserve and improve air quality in the United States. To accomplish this, OAQPS:

- compiles and reviews air pollution data,
- develops regulations to limit and reduce air pollution,
- assists states and local agencies with monitoring and controlling air pollution,
- makes information about air pollution available to the public, and
- reports to Congress the status of air pollution and the progress made in reducing it

Programs and projects managed by the Office of Air Quality Planning and Standards

- AIRNow Air Quality Forecast
- Air Quality Data and Tools
- Criteria Air Pollutants Carbon Monoxide, Ground level Ozone, Lead, Nitrogen Oxides, Particulate Matter, Sulfur Dioxide
- Hazardous Air Pollutants
- Mercury and Air Toxics Standards
- Permitting Under the Clean Air Act
- Stationary Sources of Air Pollution
- Technical Air Pollution Resources
- Visibility and Regional Haze

- Voluntary Programs for Improving Air Quality

Mail code: C404 04 | EPA mailing addresses
Location: Research Triangle Park, North Carolina

OAQPS Organization

Peter Tsirigotis, Director

- Phone: 919-541-5616

Mike Koerber, Deputy Director

- Phone 919 541 5616

OAQPS includes:

- Air Quality Assessment Division
  Richard Wayland, Director
  - Phone: 919-541-4603
- Air Quality Policy Division
  Scott Mathias, Director
  - Phone: 919-541-5310
- Health and Environmental Impacts Division
  Erika Sasser, Director
  - Phone: 919-541-3889
- Outreach and Information Division
  Anna Wood, Director
  - Phone: 919-541-3604
- Sector Policies and Programs Division
  Penny Lassiter, Director
  - Phone: 919-541-5396

Office of Atmospheric Programs (OAP)

What We Do

OAP protects the ozone layer, addresses climate change, and improves regional air quality. It runs market based programs such as the Acid Rain Program and public/private partnership programs such as ENERGY STAR.

Programs and projects managed by the Office of Atmospheric Programs

- Acid rain
- AgSTAR
- Center for Corporate Climate Leadership
- Climate Change Indicators in the U.S.
- Coalbed Methane Outreach Program
- Combined Heat and Power Partnership
- Cross State Air Pollution Rule
- ENERGY STAR
- Fluorinated Gas Partnership Programs

- Global Methane Initiative
- Green Power Partnership
- GreenChill
- Greenhouse Gas Inventory, U.S.
- Greenhouse Gas Reporting Program
- Landfill Methane Outreach Program
- Ozone Layer Protection
- Responsible Appliance Disposal (RAD) Program
- Energy Resources for State, Local, and Tribal Governments
- UV Index
- Voluntary Methane Programs for the Oil and Natural Gas Industry

Mail code: 6201A | EPA mailing addresses
Location: EPA Headquarters in Washington, D.C.

OAP Organization

Chris Grundler, Director

- Phone: (202) 343-9140

OAP includes:

- Clean Air Markets Division
  Reid Harvey, Director
  - Phone: (202) 343-9429
- Stratospheric Protection Division
  Cynthia Newberg, Director
  - Phone: (202) 343-9729
- Climate Change Division
  Paul Gunning, Director
  - Phone: (202) 343-9876
- Climate Protection Partnerships Division
  Carolyn Snyder, Director
  - Phone: (202) 343-9137

Office of Transportation and Air Quality (OTAQ)

What We Do

OTAQ's mission is to protect human health and the environment by reducing air pollution and greenhouse gas emissions from mobile sources and the fuels that power them, advancing clean fuels and technology, and encouraging business practices and travel choices that minimize emissions. OTAQ's programs address emissions from the range of mobile sources: cars and light trucks, large trucks and buses, farm and construction equipment, lawn and garden equipment, marine engines, aircraft, and locomotives.

OTAQ's primary activities include:

- Assessing mobile source-related air quality problems and developing sophisticated modeling tools to develop solutions, measure results, and support emission inventories.
- Establishing national standards to reduce emissions from on-road and nonroad mobile sources of pollution.
- Implementing national mobile source standards through certification processes and in-use monitoring strategies.
- Developing fuel efficiency programs and technologies to reduce the emission of greenhouse gases from the transportation sector.
- Researching, evaluating, and developing advanced technologies for controlling emissions, as well as developing new strategies for improving fuel efficiency.

OTAQ's National Vehicle and Fuel Emissions Laboratory provides OTAQ with emissions testing services in support of rulemakings, certification, enforcement actions, and test procedures development.

Programs and projects managed by the Office of Transportation and Air Quality

- View the complete list on Key Issues, Websites and Programs related to Transportation, Air Pollution, and Climate Change page
- View an A-Z Index of all transportation, air pollution, and climate change topics

Mail code: 6401A | EPA mailing addresses
Location: EPA Headquarters at Washington, D.C.

OTAQ organization chart

OTAQ Organization

Sarah Dunham, Director

- Phone: (202) 564-1682

OTAQ includes:

- Assessment and Standards Division
  Bill Charmley, Director
  - Phone: (734) 214-4466
- Compliance Division
  Byron Bunker, Director
  - Phone: (734) 214-4155
- Testing and Advanced Technology Division
  David Haugen, Director
  - Phone: (734) 214-4366
- Transportation and Climate Division
  Karl Simon, Director
  - Phone: (202) 564-7918

Office of Radiation and Indoor Air (ORIA)

What We Do

ORIA's mission is to protect the public and the environment from the risks of radiation and indoor air pollution. The office coordinates across the Agency and with other federal, state, tribal, and non-governmental organizations to carry out its mission. ORIA develops criteria, standards, guidance, policies, and programs to limit unnecessary radiation exposure and control exposure to indoor air pollutants. The office:

- provides technical assistance to states and tribes through EPA's Regional offices, and to other national and international organizations having radiation and indoor air protection programs;
- directs an environmental radiation monitoring program;
- responds to radiological emergencies; and
- evaluates and assesses the overall risk and impact of radiation and indoor air pollution.

Programs and projects managed by the Office of Radiation and Indoor Air

- Asthma
- Radiological Emergency Response
- Creating Healthy Indoor Air Quality in Schools
- Indoor Air Quality in Tribal Communities
- Indoor Air Quality
- Indoor airPLUS
- Mold and Moisture
- Radon
- Radiation
- RadNet
- RadTown
- Radiation Regulations and Laws
- Federal Guidance for Radiation Protection
- Smoke-free Homes

Mail code: 6608T | EPA mailing addresses
Location: EPA Headquarters at Washington, D.C.

ORIA Organization

Jonathan Edwards, Director

- Phone: (202) 343-9320

The Office of Radiation and Indoor Air includes:

- Radiation Protection Division
  Lee Veal, Director
  - Phone: (202) 343-9448
- Indoor Environments Division
  David Rowson, Director
  - Phone: (202) 343-9370

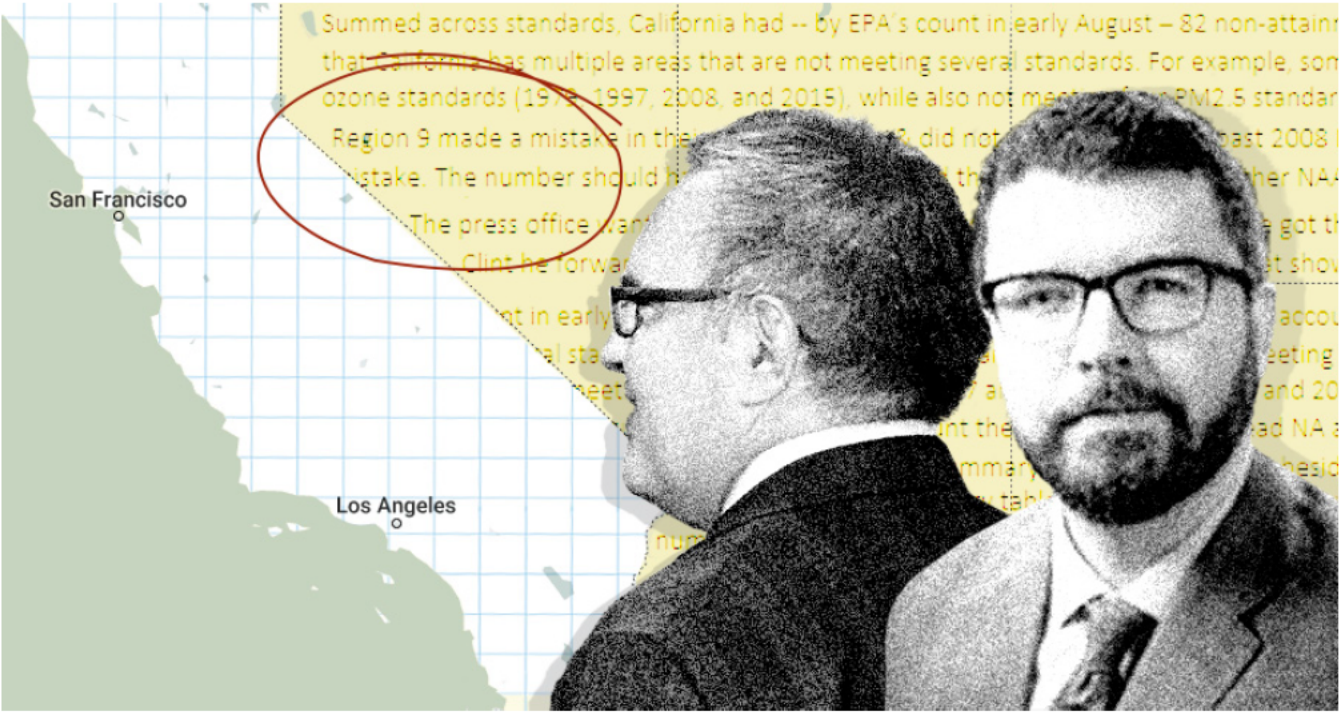
- Program Management Office
  Pamela Bullard, Director
  - Phone: (202) 343-9011
- National Analytical Radiation Environmental Laboratory
  Dr. John Griggs, Director
  - Phone: (334) 270-3401
- National Center for Radiation Field Operations
  Edward Wilds, Director
  - Phone: (702) 784-8200

LAST UPDATED ON JANUARY 20, 2021

EPA

Former air deputy helped Wheeler threaten Calif.

Maxine Joselow, E&E News reporter • Published: Monday, December 16, 2019



Emails obtained under the Freedom of Information Act show the role former EPA deputy air chief Clint Woods played in helping Administrator Andrew Wheeler with his threats to revoke California's highw funds. Claudine Hellmuth/E&E News(illustration); EPA(Woods and Wheeler); FOIA(email documents); SnazzyMaps(map)

This story was updated at 5:34 p.m. EST.

Newly released emails shed more light on the key role played by a former EPA political appointee in Administrator Andrew Wheeler's threat to revoke California's highway funds.

At issue is Wheeler's September letter to the California Air Resources Board in which he threatened to revoke he state's highway funds over its alleged failure to comply with the Clean Air Act (*Greenwire*, Sept. 24).

The emails show that Clint Woods, the former deputy EPA air chief, played a pivotal role in gathering data to back up Wheeler's claims — data that was criticized as inaccurate by CARB and California Democrats.

E&E News obtained the emails through a Freedom of Information Act request to EPA Region 9, which covers the Pacific Southwest.

In his letter to CARB, Wheeler wrote hat California had "failed to carry out its most basic tasks under he Clean Air Act" and had " he worst air quality in he United States."

To bolster his claims, the EPA chief asserted hat the Golden State had "82 nonattainment areas and 34 million people living in areas hat do not meet National Ambient Air Quality Standards — more than twice as many people as any o her state in the country."

Mere hours after Wheeler sent his letter, EPA's press office began fielding questions about the accuracy of the 82 figure.

"Do you have a list of the 82 nonattainment areas? I get a different count when I look here," wrote a reporter for Bloomberg Environment, linking to EPA's own data set.

EPA's press office sprung into high gear after receiving several more inquiries.

"The press office wants us to provide a response to the questions of how we got the 82 non-attainment areas," Isabel DeLuca, deputy director of communications in the air office, wrote to colleagues.

In he quest to track down the figure's origins, all signs pointed to Woods.

DeLuca wrote hat Woods had created an Excel spreadsheet " hat shows how they got the number."

Corey Mocka, a physical scien ist at EPA, similarly told colleagues: "Looks like Clint used an August 5 email from Matt Lakin to develop his 82 number." Lakin is chief of planning in EPA Region 9's air office.

Mocka added, "[EPA Communica ions Director] John Millett wrote a short statement for the 5 pm press deadline, but [the Office of Air Quality Planning and Standards] s ill needs to compare Clint's spreadsheets and develop a response to the 82 areas ques ion. It keeps coming up."

The issue eventually caught the atten ion of Democratic lawmakers on Capitol Hill.

Last month, California Democrats on the House Energy and Commerce Committee took issue wi h Woods' math in a letter to EPA's Office of Inspector General requesting an investigation into the matter (*E&E News PM*, Nov. 25).

"The letter incorrectly references 82 nonattainment areas in the state of California," the lawmakers wrote. "As CARB has pointed out, in arriving at this number, EPA at times counted one single area repeatedly and included sovereign tribal communities for which the state is not responsible."

They concluded: "When accounting for these miscalculations, the number of nonattainment areas is actually 20, far fewer han the original estimate of 82."

Woods has attracted controversy since leaving the agency in October.

After taking a job at Ohio State University, Woods faced pushback last month from some students and faculty, who questioned his role in industry-backed efforts to ease air pollu ion regulations and limit EPA's use of science (*Greenwire*, Nov. 22).

Asked for comment, EPA spokesman Michael Abboud said in an emailed statement to E&E News: "EPA Region 9 has been working wi h EPA headquarters and will continue to work with them to bring California into compliance while delivering environmental and health protections to the tens of millions of its residents. Unlike previous administra ions that were complacent with noncompliance, this administration will not let these serious environmental failures languish. California faces significant environmental issues that need to be addressed."

Abboud added, "I would also like to point out that his is a dumb story."

Woods didn't respond to a request for comment over the weekend.

Clarification: This story previously stated that EPA Administrator Andrew Wheeler's assertion about the number of nonattainment areas in California was "roundly" criticized. It was criticized largely by the California Air Resources Board and California Democrats.

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Oversight finds EPA political appointees slow-walked ethics obligations

BY REBECCA BEITSCH 01/17/20 03 29 PM EST

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A House Oversight and Reform Committee review found the Environmental Protection Agency (EPA) let political appointees take months to sign required ethics pledges and compile recusal lists, allowing leaders to work on issues where they had substantial conflicts of interest, the panel argued.

An executive order signed during President Trump's second week in office requires federal employees to avoid working with former clients for their first two years.

"These documents indicate that EPA allowed senior agency officials to avoid or delay completing required ethics forms and that EPA was missing forms entirely for some officials," committee Chairwoman Carolyn Maloney (D-N.Y.) and subcommittee Chairman Harley Rouda (D-Calif.) wrote in a letter to the agency.

"The Committee identified multiple instances in which EPA officials failed to complete required ethics documents or sign ethics pledges required by Executive Order 13770. EPA also allowed officials to delay the finalization of critical ethics agreements for significant periods of time after joining the agency."

The review found that at least five employees did not have signed ethics pledges as required by the executive order. Another eight took an average of 49 days to sign their ethics pledges.

It also found significant delays from appointees in preparing recusal tatement , which require them to li t off former client they mu t avoid to skirt any conflicts of interest.

The letter highlight lap e by one EPA employee in particular, Bill Wehrum, the former assistant administrator for the Office of Air and Radiation, who wa dogged by ethic complaint during hi tenure in the office before resigning in June.

Calling it an "egregiou ca e," the analy i found Wehrum took 300 day to finalize his recusal statement, in the interim leading on a number of air regulation beneficial to former client from hi day a a coal, oil and ga lobbyist.

That include an effort to change tailpipe emi ion and fuel economy standards for vehicles.

Reached for comment, the EPA argued it political appointee have been following ethics guidelines.

"All EPA appointee and advi ory board member take their ethic obligations seriously and endeavor to comply with ethics laws and guideline , and the requirement under the Trump ethic pledge, to ay otherwise is just flat out false. EPA has provided multiple responses to the Committee on thi topic and the Committee ha not once rai ed a ingle issue with EPA during our ongoing productions of responsive documents. It i trange that the Committee would wait month to rai e thi i ue in the press and not during those discussions," an agency spokesperson said by email

But other reviews of the EPA's ethics practices likewise found the agency wa not properly meeting obligation

A 2017 Office of Government Ethic report found multiple lap e in EPA ethics practices.

Another July report from the Government Accountability Office found the EPA skirted rules when appointing industry leaders to science boards, failing to en ure all tho e appointee met ethic requirement

"EPA also did not consistently ensure that members appointed as special government employee (SGE) who are expected to provide their be t judgment free from conflicts of interest and are required by federal regulation to di clo e their financial intere t met federal ethic requirements," the report said, adding that there should have been more periodic review of it ethic program

TAGS CAROLYN MALONEY HARLEY ROUDA DONALD TRUMP ENVIRONMENTAL PROTECTION AGENCY ETHICS

SHARE TWEET

Workpaper - OA&E-FY19-0091 EPA Actions to Address Elevated Cancer Risks from Air Toxics Emissions from Point Sources

Created By: Bao Chuong 2/14/2020

Section: L.08
Subject: R1 - Bill Wehrum Email Review
Program Name: Email Analyses

Information:

Status: In Progress **Review:**

In Progress Editors:

Current Editors: Roles: AIG_DAIG, Assigned Auditor, Audit In-Charge, Audit Manager, New employee, Product Line Director, Quality Assurance

Issues:

Comments:

Attachments:

1.9.19 652am (b) (5) [redacted] 115744 KB, Source AD, , 02/20/2020 16:22:29
2.20.19 340pm (b) (5) [redacted] 111152 KB, Source AE, , 02/20/2020 17:24:57
6.21.18 9am (b) (5) [redacted], 126752 KB, Source AI, , 03/19/2020 18:59:49
6.21.18 554pm (b) (5) [redacted] 574320 KB, Source G, , 02/14/2020 22:13:03
6.21.18 836am (b) (5) [redacted], 119168 KB, Source F, , 02/18/2020 17:05:39
6.22.18 505am (b) (5) [redacted], 176320 KB, Source H, , 02/18/2020 17:07:14
6.22.18 1003am (b) (5) [redacted] 637056 KB, Source J, , 02/14/2020 23:51:07
6.22.18 1057am (b) (5) [redacted] 724624 KB, Source K, , 02/14/2020 23:50:44
6.22.18 1115am (b) (5) [redacted] KB, Source L, , 02/14/2020 23:50:13
6.22.18 1238pm (b) (5) [redacted] 640512 KB, Source M, , 02/14/2020 23:49:55
6.22.18 (b) (5) [redacted] 26368 KB, Source I, , 02/14/2020 23:51:22
7.26.18 121pm (b) (5) [redacted] 1724672 KB, Source N, , 02/18/2020 21:31:38

7.26.18 425pm (b) (5) [redacted] 186896 KB, Source O, , 02/18/2020 21:38:40
8.13.18 751am (b) (5) [redacted], 283760 KB, Source AG, , 02/20/2020 22:12:41
8.14.18 1252pm (b) (5) [redacted], 228848 KB, Source AF, , 02/20/2020 18:52:49
8.19.18 914 AM (b) (5) [redacted], 147120 KB, Source P, , 02/18/2020 21:50:34
8.21.18 346pm (b) (5) [redacted] 1483536 KB, Source Q, , 02/18/2020 21:59:40
8.21.18 349pm (b) (5) [redacted] 179472 KB, Source R, , 02/18/2020 22:08:37
8.22.18 325pm (b) (5) [redacted] 240672 KB, Source T, , 02/18/2020 22:47:03
8.22.18 1120am (b) (5) [redacted], 630976 KB, Source S, , 02/18/2020 22:31:41
9.11.18 435pm (b) (5) [redacted], 98368 KB, Source Y, , 02/19/2020 22:20:18
9.26.18 222pm (b) (5) [redacted] 133936 KB, Source AB, , 02/19/2020 23:03:28
9.26.18 244pm (b) (5) [redacted], 109136 KB, Source Z, , 02/19/2020 22:49:13
9.26.18 1018am (b) (5) [redacted] 174448 KB, Source U, , 02/19/2020 14:01:55
9.26.18 1150am (b) (5) [redacted], 99344 KB, Source X, , 02/19/2020 15:30:34
10.3.18 535am (b) (5) [redacted] 45120 KB, Source AH, , 02/20/2020 22:31:56
11.7.18 1130am (b) (5) [redacted] 318160 KB, Source AC, , 02/20/2020 13:38:36
(b) (5) [redacted] 84560 KB, Source V, , 02/19/2020 14:37:15
(b) (5) [redacted] 166448 KB, Source A, , 02/14/2020 17:12:30
Document1.docx, 8784 KB, Default Description, , 02/14/2020 15:29:51
(b) (5) [redacted], 151904 KB, Source W, , 02/19/2020 14:42:19
Email review methodology.docx, 17744 KB, Source D, , 02/14/2020 17:18:32
(b) (5) [redacted], 15648 KB, Source AA, , 02/19/2020 22:47:23
FW_ OA&E-FY19-0091_ REQUEST FOR ACCESS TO E-MAIL RECORDS.pdf, 202352 KB, Source C, , 02/14/2020 17:18:00
OA&E-FY19-0091_ REQUEST FOR ACCESS TO E-MAIL RECORDS (Approval Attached Below).pdf, 344336 KB, Source B, , 02/14/2020 17:13:22
WP L.08 - Bill Wehrum email review.docx, 76752 KB, Workpaper Narrative, , 02/03/2021 12:48:43

Approval:

Preliminary Approval, Renee McGhee-Lenart, 04/07/2020 10:17:23

History:

Bao Chuong, 02/14/2020 15:29:51, Created
Bao Chuong, 02/18/2020 17:05:55, (b) (5) [redacted]
Bao Chuong, 02/18/2020 17:07:24, (b) (5) [redacted]
Bao Chuong, 03/19/2020 11:02:02, Edited
Bao Chuong, 04/01/2020 22:11:39, Edited

Renee McGhee-Lenart, 04/07/2020 10:17:23, Preliminary Approval
Renee McGhee-Lenart, 04/07/2020 10:17:28, Edited
Renee McGhee-Lenart, 04/07/2020 10:17:34, Edited
Renee McGhee-Lenart, 04/07/2020 10:17:41, Edited

Evaluation of EPA Actions to Address Elevated Cancer Risks from Air Toxics Emissions from Point Sources
OA&E-FY19-0091
WP L.12

PURPOSE: To determine whether any directives were disclosed in the emails of Clint Woods, Deputy Assistant Administrator for Air and Radiation.

SCOPE: Reviewed the emails of Clint Woods, Deputy Assistant Administrator for Air and Radiation, to determine whether any directives were disclosed in them. The emails reviewed were from December 2017 to June 2019.

SOURCE: (b) (5) [redacted]

Prepared by:	Date
Bao Chuong	4/2/20
Approved by:	**Date**
Renee McGhee-Lenart	4/8/20

(b) (5) [redacted]

Prepared by:	Date
Bao Chuong	4/2/20
Approved by:	**Date**
Renee McGhee-Lenart	4/8/20

(b) (5)

[redacted]

Prepared by:	Date
Bao Chuong	4/2/20
Approved by:	**Date**
Renee McGhee-Lenart	4/8/20

<u>CONCLUSION</u>: One of the seven directives brought up by Region 5 were corroborated by a sequence of emails. Specifically, the review found a sequence of emails showing that it was HQ that ordered the Region 5 website on Sterigenics to be taken down after it went live for about an hour on 8/22/18. (Details section > Table 3) A series of emails between Mike Koerber and Clint Woods from 8/22/18 – 8/24/18 suggest that it was Clint Woods that ordered the website be taken down. (Source AA)

Although six of the seven directives were not found in Clint Woods's emails, one of the six directives were found in a sequence of emails in Bill Wehrum's email file. Specifically, the directive to not issue a press release or release the May 2018 Sterigenics monitoring results was found in that sequence of emails. (Link: L.08 > Details section > subsection "Results on Directives" > sub-subsection "Not to issue a press...." including Table 2) With regards to the other five directives, individuals in Region 5, Region 6, OAQPS, and/or OECA stated that such directives were issued by HQ as shown in Link: L.14 > Details section > Tables 3, 4, 5, 6, and 7.

<u>DETAILS</u>:

BACKGROUND

We learned from interviews with Region 5 managers and staff that the Office of Air and Radiation (OAR) issued the following directives:

- Not to issue a press release or release the May 2018 monitoring results for the Sterigenics facility in Willowbrook, Illinois. (b)(5) [redacted]
- Pull down the Region 5 Sterigenics website after it went live for about an hour on 8/22/18. (b)(5 [redacted]
- Not to send 114 letters to facilities. (b)([redacted]

Prepared by:	Date
Bao Chuong	4/2/20
Approved by:	**Date**
Renee McGhee-Lenart	4/8/20

(b) (5) [redacted]

- Not to conduct monitoring (b)([redacted]
- Not to conduct inspections at ethylene oxide-emitting facilities unless invited by state to conduct joint inspection. (b) (5) [redacted]
- Seek permission from OAQPS before starting any modeling. (b) (5) [redacted]
- Not to work with ATSDR. (b) (5) [redacted]

C Link: Link: Link: Link: Link: Link: We decided to review the emails of the following 11 individuals to determine whether the above directives were disclosed in emails between December 2017 and June 2019:

Prepared by:	Date
Bao Chuong	4/2/20
Approved by:	**Date**
Renee McGhee-Lenart	4/8/20

- Bill Wehrum, Assistant Administrator for Air and Radiation.
- **B** Link: Clint Woods, Deputy Assistant Administrator for Air and Radiation.
- Cathy Stepp, Regional Administrator for Region 5.
- Kurt Thiede, Chief of Staff, Region 5.
- Mike Koerber, Deputy Director, OAQPS.
- Peter Tsirigotis, Director, OAQPS.
- Penny Lassiter, Director, Sector Policy and Programs Division, OAQPS.
- Lew Weinstock, Group Leader, Ambient Air Monitoring Group, Air Quality Assessment Division, OAQPS.
- Alison Davis, Public Affairs Specialist, Policy Analysis and Communications Staff, OAQPS.
- Kelly Rimer, Group Leader, Air Toxics Assessment Group, Health and Environmental Impacts Division, OAQPS.
- Darcie Smith, Physical Scientist, Air Toxics Assessment Group, Health and Environmental Impacts Division, OAQPS. (Source B)

(b) (5) [redacted]

(b) (5) [redacted]

(b) (5) [redacted]

[redacted]

[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted] [redacted]	[redacted] [redacted]	[redacted] [redacted]

Prepared by:	Date
Bao Chuong	4/2/20
Approved by:	**Date**
Renee McGhee-Lenart	4/8/20

(b) (5)

[redacted]

Prepared by:	Date
Bao Chuong	4/2/20
Approved by:	**Date**
Renee McGhee-Lenart	4/8/20

(b) (5) [redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
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[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

Prepared by:	Date
Bao Chuong	4/2/20
Approved by:	**Date**
Renee McGhee-Lenart	4/8/20

(b) (5) [redacted]

RESULTS ON DIRECTIVES

Below are the results of the email reviews on the specific directives.

Not to issue a press release or release the May 2018 monitoring results for the Sterigenics facility in Willowbrook, Illinois

(b) (5) [redacted]

- [redacted]
- [redacted]

Prepared by:	Date
Bao Chuong	4/2/20
Approved by:	**Date**
Renee McGhee-Lenart	4/8/20

(b) (5) [redacted]

(b) (5) [redacted]

(b) (5) [redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

Prepared by:	Date
Bao Chuong	4/2/20
Approved by:	**Date**
Renee McGhee-Lenart	4/8/20

				(b) (5) [redacted]	[redacted]	
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

Prepared by:	**Date**
Bao Chuong	4/2/20
Approved by:	**Date**
Renee McGhee-Lenart	4/8/20

				(b) (5) [redacted]	[redacted]	

Pull down the Region 5 Sterigenics website after it went live for about an hour on 8/22/18

According to Region 5, HQ told Region 5 to pull the R5 website on Sterigenics down. Table 3 below shows the sequence of emails showing that it was Clint Woods that ordered Region 5 to take down its Sterigenics website, which contained the May 2018 monitoring results and a link to the ATSDR report on Sterigenics. Of note are the following:

- (b) (5) [redacted]
- A revised/updated Region 5 website on Sterigenics went live in early October 2018. (Source X)

(b) (5) [redacted]

(b) (5) [redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

Prepared by:	Date
Bao Chuong	4/2/20
Approved by:	**Date**
Renee McGhee-Lenart	4/8/20

					(b) (5) [redacted]	
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

Prepared by:	Date
Bao Chuong	4/2/20
Approved by:	**Date**
Renee McGhee-Lenart	4/8/20

					(b) (5) [redacted]	
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

Prepared by:	**Date**
Bao Chuong	4/2/20
Approved by:	**Date**
Renee McGhee-Lenart	4/8/20

				(b) (5) [redacted]	[redacted]	
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

Not to Send 114 Letters to Facilities

Evaluator did not find anything in Clint Woods's emails in which HQ made the directive not to send 114 letters to facilities. However, (b) [redacted] individuals in Region 5, Region 6, and OAQPS (b) (5) [redacted] have stated that there was such a directive or that HQ did not allow them to send 114 letters to facilities [redacted] (b) (5) [redacted]

Not to Conduct Monitoring

Evaluator did not find anything in Clint Woods's emails showing that a no monitoring of facility ethylene oxide emissions directive from HQ or OAQPS was issued. (b) (5) [redacted] Also, (b) (5) [redacted] individuals in Region 5, Region 6, and OAQPS ((b) (5) [redacted]) have stated that there was such a directive or that HQ did not allow them to conduct monitoring of ethylene oxide emissions from facilities as shown in Link: L.14 > Details section > Table 4.

Prepared by:	Date
Bao Chuong	4/2/20
Approved by:	**Date**
Renee McGhee-Lenart	4/8/20

(b) (5) [redacted]

[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

Prepared by:	**Date**
Bao Chuong	4/2/20
Approved by:	**Date**
Renee McGhee-Lenart	4/8/20

					(b) (5) [redacted]	

Not to conduct inspections at ethylene oxide-emitting facilities unless invited by state to conduct joint inspection

Evaluator did not find anything in Clint Woods's emails in which HQ made the directive not to conduct inspections at ethylene oxide-emitting facilities unless invited by the state to conduct joint inspection. However, (b) (5) [redacted] individuals in Region 5, Region 6, OAQPS, and OECA have stated that there was such a directive or that HQ did not allow them to conduct inspections at ethylene oxide-emitting facilities unless invited by the state (b) (5) [redacted].

Seek permission from OAQPS before starting any modeling

Evaluator did not find anything in Clint Woods's emails in which HQ made the directive to seek permission from OAQPS to conduct modeling. However, (b) (5) [redacted] individuals in Region 5 and OAQPS ((b) (5) [redacted]) have stated that there was such a directive or that HQ wanted regions to coordinate with OAQPS before conducting modeling [redacted] (b) (5) [redacted].

Not to Seek Assistance from ATSDR

Evaluator did not find anything in Clint Woods's emails in which HQ made the directive to not seek assistance from ATSDR. However, (b) [redacted] individuals in Region 5 and OAQPS have stated that there was such a directive [redacted] (b) (5) [redacted].

Risk communication

(b) (5) [redacted]

Prepared by:	**Date**
Bao Chuong	4/2/20
Approved by:	**Date**
Renee McGhee-Lenart	4/8/20

Reviewer Comment **(and Date of Review)**	**Team Response** **(and Date of Response)**	**Resolution** **(and Date of Resolution)**
Minor comments addressed in document. RML 4/8/2020		WP approved. RML 4/8/20

Prepared by:	**Date**
Bao Chuong	4/2/20
Approved by:	**Date**
Renee McGhee-Lenart	4/8/20

From: Siegel, Kathryn
To: Chuong, Bao
Subject: RE: OIG follow-up again
Date: Friday, January 29, 2021 10:24:08 AM

Hi Bao,

That is correct.

Katie Siegel, Chief
Air Toxics and Assessment Branch
Air and Radiation Division
U.S. EPA Region 5
siegel.kathryn@epa.gov
(312) 886-3006

From: Chuong, Bao <Chuong.Bao@epa.gov>
Sent: Friday, January 29, 2021 11:19 AM
To: Siegel, Kathryn <siegel.kathryn@epa.gov>
Subject: OIG follow-up again
Importance: High

Hi Katie,

Just wanted to reconfirm – Cathy Stepp (as RA) and Kurt Thiede (as Chief of Staff) were political appointees, right?

Thanks,
Bao

Bao Chuong
EPA-OIG
75 Hawthorne St.
MC: IGA-1
San Francisco, CA 94105
(415) 947-4533

From: [redacted]
To: Chuong, Bao; McGhee-Lenart, Renee
Subject: follow-up items from interview
Date: Wednesday, April 3, 2019 12:16:02 PM
Attachments: [redacted]

Bao and Renee,

Attached are some documents regarding [redacted]

[redacted]

[redacted]

Let me know if you have additional questions, [redacted]

[redacted]

(b) (5)

[redacted]

(b) (5)

[redacted]

(b) (5)

[redacted]

Evaluation of EPA Actions to Address Elevated Cancer Risks from Air Toxics Emissions from Point Sources
OA&E-FY19-0091
WP L.02

PURPOSE: To summarize the methodology used in the Residual Risk and Technology Review/Congressional Assignment.

SCOPE: This workpaper summarizes the methodology used to review emails. The emails of the following 11 EPA personnel in the Office of Air and Radiation (OAR), Office of Air Quality Planning and Standards (OAQPS), and Region 5 were reviewed: Alison Davis, Penny Lassiter, Peter Tsirigotis, Kurt Thiede, Darcie Smith, Cathy Stepp, Bill Wehrum, Mike Koerber, Clint Woods, Kelly Rimer, and Lewis Weinstock. The email review covered emails sent or received between December 2017 to June 2019.

SOURCE:
Source A: Revised Draft Methodology Document 8.1.19

CONCLUSION: The methodology used to review emails followed the steps listed in Source A with a revision to step 4 as described in the detail section below. The revised step 4 states that emails that were not relevant were not saved and that professional judgement was used to save emails closely related to the Residual Risk and Technology Review/Congressional assignment rather than any email related to the topic.

SUMMARY:
The emails of 11 EPA management officials/managers were reviewed:

1. Alison Davis (WP L.03)
2. Penny Lassiter (WP L.04)
3. Peter Tsirigotis (WP L.05)
4. Kurt Thiede (WP L.06)
5. Darcie Smith (WP L.13)
6. Cathy Stepp (WP L.07)
7. Bill Wehrum (WP L.08)
8. Mike Koerber (WP L.09)
9. Kelly Rimer (WP L.10)
10. Lewis Weinstock (WP L.11)

Prepared by:	Date
Gaida Mahgoub	03/05/2020
Approved by:	**Date**
Renee McGhee-Lenart	3/18/2020

11. Clint Woods (WP L.12)

The methodology has six steps:

1. Step 1: Review all folders in personnel mailbox for emails related to directives to not proceed with certain ethylene oxide work (b)(5) [redacted]
2. Step 2: Search the mailboxes for 61 key words listed in the details section below (Source A, Pages 2-3)
3. Step 3: Document the number of emails for each search term. Save the relevant emails that relate to the ethylene oxide assignment in a separate folder. Save only one copy of each email rather than duplicates that show up more than once (Source A, Page 3)
4. Step 4: Review emails that resulted from search terms. Identify and save the emails relevant to the Congressional questions/directives stated in step 1 above. The evaluator should apply professional judgement to identify any emails that are relevant to the overall assignment objectives, but not directly related to the Congressional questions/directives. Save any such emails and discuss relevant topics from such emails with the team to determine if further follow-up action or documentation is necessary.
5. Step 5: Scroll through the inboxes of the agency personnel and save any emails related to ethylene oxide strategies, ethylene oxide emissions, chloroprene emissions, neoprene emissions, or Region 5 activities to ensure that no relevant emails were missed.
6. Step 6: Save emails as Adobe PDF by following the steps outlined in the details section in step 6 below

Prepared by:	Date
Gaida Mahgoub	03/05/2020
Approved by:	Date
Renee McGhee-Lenart	3/18/2020

DETAILS:

Scope:

The emails of 11 EPA personnel in OAR, OAQPS, and Region 5 were reviewed. The OIG team split these 11 email reviews as follows:

- Gaida Mahgoub reviewed emails of:
    1. Alison Davis, Public Affairs Specialist, Office of Air Quality Planning and Standards (OAQPS)-Policy Analysis and Communications Staff (PACS) (WP L.03)
    2. Penny Lassiter, Group Leader of Refining and Chemicals Group, Sector Policies and Programs Division (SPPD) OAQPS (WP L.04)
    3. Peter Tsirigotis, Director of SPPD, OAQPS (WP L.05)
    4. Kurt Thiede, previous Chief of Staff Region 5, current Regional Administrator for Region 5 (WP L.06)
    5. Darcie Smith, Physical Scientist OAQPS- Health and Environmental Impacts Division (HEID) (WP L.13)
- Bao Chuong reviewed emails of:
    6. Cathy Stepp, previous Region 5 Regional Administrator (WP L.07)
    7. Bill Wehrum, Previous Assistant Administrator of OAR (WP L.08)
    8. Mike Koerber, Deputy Director, OAQPS (WP L.09)
    9. Clint Woods, Previous Deputy Assistant Administrator, OAR (WP L.12)
- Andrew Lavenburg reviewed emails of:
    10. Kelly Rimer, Supervisory Environmental Protection Specialist, OAQPS-Health and Environmental Impacts Division (HEID) (WP L.10)
    11. Lewis Weinstock, Supervisory Physical Scientist, OAQPS-Air Quality Assessment Division (AQAD) (WP L.11)

The methodology has six steps:

1. Step 1: Review personnel's "inbox", "sent", and other boxes created by the agency personnel related to the assignment (b) (5) [redacted] Emails related to the directives/instructions should be saved as a pdf file (preferred) or a .msg file if pdf is not an option. Emails where agency personnel stated to call them or ask the recipient if they can talk now/soon and meeting invitations related to the directives/instructions should also be saved. Saved emails should include at least the date in the file name, and the time in EST if appropriate. These emails should be put in a separate folder to track the number of relevant emails (Source A, Bottom of Page 1):

Prepared by:	Date
Gaida Mahgoub	03/05/2020
Approved by:	**Date**
Renee McGhee-Lenart	3/18/2020

- (b) (5) [redacted]

2. <u>Step 2:</u> Search the assigned emails for the following word or words:

(b) (5) [redacted]

Prepared by:	Date
Gaida Mahgoub	03/05/2020
Approved by:	**Date**
Renee McGhee-Lenart	3/18/2020

(b) (5)

[redacted]

Prepared by:	Date
Gaida Mahgoub	03/05/2020
Approved by:	**Date**
Renee McGhee-Lenart	3/18/2020

[redacted]

3. Step 3: Document the number of emails resulting from the search terms. The evaluator should review the email results for each search term and use professional judgement to determine if the emails relate to the subject matter and objectives of the assignment. For example, a search for the term "monitor" may produce emails related to a variety of topics outside the scope of this assignment. Any emails resulting from key word searches that the evaluator deems to be relevant to the subject matter and objectives of the assignment should be saved in folder separate from the one in step 1. The evaluator should be cognizant of the fact that some search results are likely to be duplicated by searches for other key words (i.e., some emails resulting from a search for the term "[redacted] are also likely to show up as search results for the term "[redacted] and make efforts to only save one copy of a given email regardless of how many times it shows up a result of different key word searches.

4. Step 4: Review emails that resulted from search terms. Identify and save the emails relevant to the Congressional questions/directives stated in step 1 above. The evaluator should apply professional judgement to identify any emails that are relevant to the overall assignment objectives, but not directly related to the Congressional questions/directives. Save any such emails and discuss relevant topics from such emails with the team to determine if further follow-up action or documentation is necessary.

Prepared by:	**Date**
Gaida Mahgoub	03/05/2020
Approved by:	**Date**
Renee McGhee-Lenart	3/18/2020

5. Step 5: Scroll through all of the emails for the individual you are assigned and review any emails not identified in the searches that have a title that relates to the following: ethylene oxide strategies, ethylene oxide emissions, chloroprene emissions, neoprene emissions, or Region 5 activities. This step will help us confirm that we did not miss any relevant emails with our search terms. Please save these additional emails in a folder separate from the ones in other steps.

6. Step 6: For the emails that are found, please save in the following manner.

    - Create a new folder for emails (Press folder in Outlook, New folder, and name folder)
    - Press File in Outlook
    - Press Save as Adobe pdf (If Outlook won't let you save as a pdf file, save it as msg file.) File name should include at least a date and if appropriate, time in EST for easy access in the future.
    - Put email file in the folder.

Reviewer Comment **(and Date of Review)**	**Team Response** **(and Date of Response)**	**Resolution** **(and Date of Resolution)**
Minor comments made. RML 3/18/20		WP approved. RML 3/18/20

Prepared by:	**Date**
Gaida Mahgoub	03/05/2020
Approved by:	**Date**
Renee McGhee-Lenart	3/18/2020

Congressional/RTR Assignment E-mail Search Methodology

1. For the emails assigned to each staff person, please review emails in the agency personnel's "Inbox" box, "Sent" box, and any other boxes created by the agency personnel related to our assignments (b) (5) [redacted]

(b) (5) [redacted]

(b) (5) [redacted].

Emails related to the directives/instructions should be saved as a pdf file if possible. Otherwise, save them as msg files. Please also save emails where the person only stated to call them or ask the recipient if they can talk now/soon and meeting invitations related to the directives/instructions. Saved emails should have at least the date in the file name and time in EST if appropriate. Please put these emails in a separate folder to track the number of relevant emails.

2. Please search the assigned emails for the following word or words (see below).

- (b) (5) [redacted]

2

- (b) (5) [redacted]

3. Document the number of emails resulting from the search terms. The evaluator should review the email results for each search term and use professional judgement to determine if the emails relate to the subject matter and objectives of the assignment. For example, a search for the term "monitor" may produce emails related to a variety of topics outside the scope of this assignment. Any emails resulting from key word searches that the evaluator deems to be relevant to the subject matter and objectives of the assignment should be saved in folder separate from the one in step 1. The evaluator should be cognizant of the fact that some search results are likely to be duplicated by searches for other key words (i.e., some emails resulting from a search for the term "(b) (5) [redacted] are also likely to show up as search results for the term "(b) (5) [redacted] and make efforts to only save one copy of a given email regardless of how many times it shows up a result of different key word searches.

4. Review the emails that resulted from the searches to determine whether (1) they are relevant to the Congressional questions/directives stated in step 1 above, (2) they are relevant to the assignment but not the Congressional questions/directives, or (3) they are not relevant to the assignment. Please put these saved emails in 3 separate folders.

5. Scroll through all of the emails for the individual you are assigned and review any emails not identified in the searches that have a title that relates to the following: ethylene oxide strategies, ethylene oxide emissions, chloroprene emissions, neoprene emissions, or Region 5 activities. This step will help us confirm that we did not miss any relevant emails with our search terms. Please save these additional emails in a folder separate from the ones in other steps.

6. For the emails that are found, please save in the following manner.

    1. Create a new folder for emails (Press folder in Outlook, New folder, and name folder)
    2. Press File in Outlook
    3. Press Save as Adobe pdf (If Outlook won't let you save as a pdf file, save it as msg file.) File name should include at least a date and if appropriate, time in EST for easy access in the future.
    4. Put email file in the folder.

Evaluation of EPA Actions to Address Elevated Cancer Risks from Air Toxics Emissions from Point Sources
OA&E-FY19-0091
WP L.3

<u>PURPOSE</u>: To analyze and summarize key email search results of directives from EPA's Office Air and Radiation (OAR) leadership regarding Region 5. This workpaper focuses on Alison Davis's emails. Alison Davis is a Public Affairs Specialist in the Office of Air Quality Planning and Standards Policy Analysis and Communications Staff.

<u>SCOPE</u>: Following the Revised Congressional/RTR Assignment E-mail Search Methodology (see WP L.2), emails related to directives/instructions provided to Region 5 between June 22, 2018 to February 11, 2019 from Alison Davis are summarized in this workpaper.

<u>SOURCES</u>: Emails Attachments
Source A 6/21/18 1:30pm Outlook file
Source B 6/21/18 1:30pm Word doc attachment
Source C 6/21/18 1:57pm PDF
Source D 6/21/18 3:18PM Email PDF
Source E 6/21/18 3:40PM Email PDF
Source F 6/21/18 3:25PM Outlook file
Source G 6/21/18 3:25PM Word
Source H 6/21/18 3:25PM PPT
Source I 6/21/18 3:25PM PDF
Source J 6/21/18 3:26pm PDF
Source K 6/21/18 4:14PM PDF
Source L 6/21/18 6:05pm PDF
Source M 6/21/18 8:12pm PDF
Source N 6/22/18 8:22am PDF
Source O 06/22/18 1:54pm PDF
Source P 6/22/18 1:58pm Outlook
Source Q 6/22/18 1:58pm PDF
Source R 6/22/18 1:58pm Word

Prepared by:	Date
Gaida Mahgoub	2/13/2020
Approved by:	**Date**
Renee McGhee-Lenart	2/18/2020

Source S 6/22/18 5:07pm PDF
Source T 6/24/18 3:03pm PDF
Source U 8/19/18 2:29PM PDF
Source V 8/19/18 3:30pm PDF
Source W 8/19/18 3:30pm Word
Source X 8/21/18 6:03pm PDF
Source Y 8/22/18 9:51am PDF
Source Z 8/22/18 3:19pm PDF
Source AA 8/22/18 5:40pm PDF
Source AB 8/22/18 1:51pm PDF
Source AC 8/24/18 8:15pm PDF
Source AD 9/10/18 9:25am PDF
Source AE 9/26/18 8:14AM PDF
Source AF 9/26/18 8:14AM Word
Source AG 9/26/18 11:01am PDF
Source AH 9/26/18 11:19am PDF
Source AI 9/26/18 1:31pm PDF
Source AJ 9/26/18 2:06pm PDF
Source AK 9/26/18 2:06pm Word
Source AL 9/26/18 2:16pm PDF
Source AM 9/26/18 2:16pm Letter PDF
Source AN 9/26/18 4:50PM PDF
Source AO 9/27/18 1.46pm PDF
Source AP 9/27/18 1.46pm Website PDF
Source AQ 9/27/18 5:13pm PDF
Source AR 9/27/18 5:13pm Website PDF
Source AS 9/28/18 11:16am PDF
Source AT 10/17/18 4:57pm PDF
Source AU 10/18/18 11:11am PDF
Source AV 10/31/18 9:57am PDF

Prepared by:	**Date**
Gaida Mahgoub	2/13/2020
Approved by:	**Date**
Renee McGhee-Lenart	2/18/2020

Source AW 11/6/18 1:40pm PDF
Source AX 11/7/18 2:05pm PDF
Source AY 11/7/18 2:06pm PDF
Source AZ 11/8/18 10:50am PDF
Source BA 2/13/19 2:23pm PDF
Source BB 8/21/18 6:03pm Word
Source BC 10/17/18 5:07pm PDF
Source BD 8/21/18 6:03pm Word
Source BE 11/13/18 4:01 PDF
Source BF 9/26/18 4:50pm Email Thread PDF
Source BG 8/1/18 2:08pm Email Thread PDF
Source BH 8/1/18 2:08pm Attachment PDF
Source BI 8/1/18 2:08pm Web Outline Word
Source BJ 8/1/18 2:08pm Talking Points Word
Source BK 8/22/18 9:21am PDF
Source BL 8/29/18 9:52am PDF
Source BM 8/29/18 12:20pm PDF
Source BN 8/29/18 12:20pm Word
Source BO 8/29/18 1:26pm PDF
Source BP 8/29/18 1:26pm Word

The following individuals, with their titles, sent or received the emails below.

- Alison Davis, Public Affairs Specialist, Office of Air Quality Planning and Standards (OAQPS)-Policy Analysis and Communications Staff (PACS)
- Bill Wehrum, Previous Assistant Administrator, Office of Air and Radiation (OAR)
- Mike Koerber, Deputy Director, OAQPS
- Nancy Grantham, Principal Deputy Associate Administrator, Office of Public Affairs
- John Millett, Supervisory Public Affairs Specialist, OAR

Prepared by:	Date
Gaida Mahgoub	2/13/2020
Approved by:	**Date**
Renee McGhee-Lenart	2/18/2020

- Jeff Kelley, Director, Office of External Communications, Region 5
- Clint Woods, Previous Deputy Assistant Administrator, OAR
- Ed Nam, Director, Land, Chemicals, and Redevelopment Division, Region 5 (Previous Region 5 Director, Air and Radiation Division)
- Erika Sasser, Program Specialist, OAQPS-Health and Environmental Impacts Division (HEID)
- Richard Wayland, Director of Air Quality Assessment Division (AQAD), OAQPS
- Peter Tsirigotis, Director of Sector Policies and Programs Division, OAQPS
- Isabel DeLuca, Public Affairs Specialist, OAR
- Eileen Deamer, Lead Region Coordinator, Region 5
- Kelly Rimer, Supervisory Environmental Protection Specialist, OAQPS-HEID
- Kurt Thiede, previous Chief of Staff Region 5, current Regional Administrator for Region 5
- Michael Hawthorne, Chicago Tribune reporter
- Cathy Stepp, previous Region 5 Regional Administrator
- Laura McKelvey, Supervisory Physical Scientist, OAQPS
- Patrick Lessard OAQPS-Sector Policies and Programs Division (SPPD)
- Joshua Singer, Public Affairs Specialist, Region 5
- Anne Rowan, Section Chief, Region 5
- Jenny Noonan, Supervisory Environmental Protection Specialist OAQPS-PACS
- Kristen Bremer, Management and Program Analyst OAQPS-PACS
- Darcie Smith, Physical Scientist OAQPS-HEID
- David Applegate, Special Projects Manager, Office of U.S. Senator Tammy Duckworth
- Patricia Haman, Congressional Liaison Specialist, Office of the Administrator (AO)
- Jackie Ashley, Environmental Protection Specialist OAQPS-PACS
- Sara Terry, Management & Program Analyst OAQPS-HEID
- Robin Richardson, Principal Deputy Associate Administrator, AO
- Karen Thundiyil, Regulatory Impact Analyst, AO
- Jack Bowles, Supervisory Program Analyst, AO
- Voronina McKinney, Program Specialist, reports to Peter Tsirigotis, OAQPS
- John J Kim, Chief Legal Counsel of Illinois EPA
- David Cozzie, Supervisory Environmental Protection Specialist OAQPS-SPPD
- Lewis Weinstock, Supervisory Physical Scientist, OAQPS-Air Quality Assessment Division (AQAD)

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- Mayor Frank Trilla, Mayor of Willowbrook
- Tim Halik, Village Administrator of Willowbrook
- Mayor Mickey Straub, then Burr Ridge Mayor
- Mayor Kathleen Weaver of the Village of Darien
- James Thurman, Physical Scientist, OAQPS-Air Quality Policy Division (AQPD)
- Mark Morris, Environmental Engineer OAQPS-HEID
- Mark Johnson, ATSDR Senior Representative at Region 5
- Amy Vasu, Environmental Protection Specialist, OAQPS-HEID
- Jeff Whitlow, Management and Program Analyst, OAQPS
- Holly Wilson, Environmental Protection Specialist, OAQPS-Outreach and Information Division (OID)
- Pam Long, Environmental Protection Specialist, OAQPS-AQPD
- Jan Cortelyou-Lee, Communication Specialist, OAQPS-PACS
- Robin Langdon, Economist, OAQPS-HEID 919-541-5695
- Penny Lassiter, Group Leader of Refining and Chemicals Group, OAQPS-SPPD
- James Payne, Deputy General Counsel for Environmental Media and Regional Law Offices
- Scott Monroe, Supervisory Management Analyst, OAR, 202-564-1271
- Mark Johnson, Region 5 Regional Director, Agency for Toxic Substances and Disease Registry (ATSDR),
- Patrick Young, ATSDR Region 6 Regional Representative, US Public Health Service, (214) 665-8562
- Kathryn Siegel, Branch Chief, Region 5
- Lissa Druss, Serafin & Associates Inc.
- Alexis Cain, Team Leader, Region 5
- Michelle Colledge, Research Officer, Air Toxic Substance and Disease Registry
- Doug Ballotti, Director, Superfund and Emergency Management Division, Region 5
- Thomas Short, Acting Director, Water Division, Region 5
- Cheryl Newton, Deputy Regional Administrator, Region 5

The following individuals sent or received the emails below, but no titles were found for the following individuals:

- Mandy Gunasekara
- John Konkus
- Matthew Davis

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- Jennifer McConahy
- Troy Lyons
- Aaron Ringel
- Christian Palich
- Christian Rodrick AO
- Tony (Robert) Frye, AO
- Ned Shappley OAQPS-AQAD
- Paula Selzer
- George Bollweg

CONCLUSION: Several emails indicated that Region 5 needed to check with EPA before moving forward with certain ethylene oxide activities and other emails indicate that certain activities have been stopped. Many of the directives seemed to have been made during in-person meetings and updates were provided via phone. There are email indications of when meetings and phone calls took place.

DETAILS:

Alison Davis Significant Emails

- On June 22, 2018, an email thread shows that Bill Wehrum, then Assistant Administrator for the Office of Air and Radiation (OAR), stated "Please make it clear to Region 5 that they cannot proceed until they get our concurrence" This was a direct reply to John Millet, Supervisory Public Affairs Specialist at OAR writing to Bill Wehrum "FYI - OAQPS is looking at this now. Region 5 is looking to issue this at noon." The draft press release is included in the email thread. (Source A, Top of Page 1)
- On August 22, 2018, Jeff Kelley writes to Nancy Grantham "(b) (5) [redacted] (Source A, Middle of Page 1)

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DATES	EMAIL SUBJECT	SUMMARY	ORIGINAL DOCUMENT(S)
6/21/2018 1:30PM	<u>Subject:</u> Fwd: Draft Sterigenics news release <u>To/From:</u> At 10:16am Jeff Kelley sends email with draft news release to Nancy Grantham (Office of Public Affairs), and CCs Anne Rowan and Joshua Singer. Nancy forwards email to John Millett who forwards it to Jenny Noonan. Jenny Noonan forwards the email to Alison Davis and Kristen Bremer	Jeff Kelly sends an email with this information stated in the draft release: (b) (5) [redacted] *(Source N, Page 1 Last Paragraph)* "(b) (5) [redacted] *(Source N, Page 2 Second Paragraph)* Nancy Grantham replies to John Millett stating: "We are on a call with bill wehrum and oaqps on this now" (Source A).	06.21.18 1.30pm R5 Briefing Fwd Draft Ste Source A 06.21.18 1.30pm 2018 June 21 Region Source B
6/21/18 1:57PM	<u>Subject:</u> are you on this ethylene oxide call with bill wehrum and region 5 -- forget whether this is your area thanks ng	Nancy Grantham asks Alison Davis if she is on the call, Alison says "yes just got pulled in"	06.21.18 1.57pm EtO call with Alison Source C

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	To/From: Nancy Grantham to Alison Davis		
6/21/2018 3:18PM	Subject: Re: Quick Call To/From: Alison Davis to Nancy Grantham, John Millett, and Kristen Bremer	Alison Davis asks for a phone call with Nancy Grantham, John Millett, and Kristen Bremer and ask for other R5 material beyond press release. Nancy says "yes, will send"	06.21.18 3.18pm Alison Davis asking Source D 06.21.18 3.40pm Quick Call.pdf Source E
6/21/18 3:25PM	Subject: FW: Draft Sterigenics news release To/From: Nancy Grantham to Alison Davis and John Millett. The thread also includes a forwarded message from Jeff Kelley to Nancy Grantham, Anne Rowan and Joshua Singer.	Nancy Grantham forwards two attachments, one of which is PowerPoint document (b) (5) [redacted] The other attachment is a briefing document that includes information (b) (5) [redacted]	06.21.18 3.25pm FW Draft Sterigenics ne Source F (b) (5) [redacted] Source G (b) (5) [redacted] Source H

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			(b) (5) [redacted] Source I
6/21/18 3:26PM	<u>Subject:</u> RE: Draft Sterigenics Website <u>To/From:</u> Kristen Bremer to Alison Davis	Kristen Bremer forwards a link to Alison Davis and says “https://wcms.epa.gov/il/sterigenics-willowbrook-facility You will first need to log into Drupal. It’s basically the Denka website”	06.21.18 3.26pm Draft Sterigenics We Source J
6/21/18 4:14PM	<u>Subject:</u> RE: Draft Sterigenics news release <u>To/From:</u> Thread between Nancy Grantham, John Millett, Alison Davis. The thread also includes a forwarded message from Jeff Kelley to Nancy Grantham, Anne Rowan and Joshua Singer.	Jeff Kelley sends a draft of the Sterigenics press release to Nancy Grantham and CC’s Anne Rowan and Joshua Singer. Nancy sends the email to John Millet at 1:07pm on June 21 saying: “We are on a call with bill wehrum and oaqps on this now” John Millett replies to Nancy and cc’s Alison Davis, saying: (b) (5) [redacted]	06.21.18 4.14pm RE Draft Sterigenics ne (not added as a source as it contains the same information as Source K but in .msg file format) 06.21.18 4.14pm Re Draft Sterigenics ne Source K
6/21/18 6:05PM	<u>Subject:</u> Fwd: Draft news release for Sterigenic	Nancy Grantham forwards the email from Jeff Kelley with the draft news release in the email body to John Millett and Alison Davis. Nancy writes “We need you to review this as they want to	06.21.18 6.05pm Draft news release f

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	To/From: Nancy Grantham to Alison Davis and John Millett	get it out tomorrow by noon cst and I will need to run it through here.”	Source L
6/21/18 8:12PM	Subject: Fwd: Draft news release for Sterigenic To/From: Ed Nam to Erika Sasser Erika Sasser then forwards the email from Ed Nam to Alison Davis, Darcie Smith, Robin Langdon, and Kelly Rimer	Ed Nam forwards the draft news release to Erika Sasser (b) (5) [redacted]	06.21.18 8.12pm Drafts news release Source M
6/22/18 8:22AM	Subject: Fwd: Draft news release for Sterigenic To/From: Bill Wehrum to John Millett and Clint Woods and ccs Mandy Gunasekara John Millett forwards email to Alison Davis.	At 7:53am, John Millett writes to Bill and Clint: “FYI - OAQPS is looking at this now. R5 is looking to issue this at noon.” The email thread includes text of the draft press release. Bill replies at 7:55am on 6/22/18 "John [Millett]– Do not give concurrence until you hear directly from me. Please make it clear to R5 that they cannot proceed until they get our concurrence."	06.22.18 8.22am Bill Wehrum Region 5 C Source N

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06/22/18 1:54PM	Subject: RE: OAQPS comments - per our discussion To/From: Jeff Kelley to John Millett and CCs Alison Davis	Jeff Kelley writes to John Millett and Alison Davis "no press release currently in the works right now"	06.22.18 1.54pm No R5 press release.pdf Source O
6/22/18 1:58PM	Subject: FW: Draft news release for Sterigenics: To/From: John Millett to Bill Wehrum and Clint Woods, and Mandy Gunasekara John Millett forwards email to Alison Davis	John Millett sends to Bill Wehrum and Clint Woods, and Mandy Gunasekara, then forwards it as FYI to Alison Davis: "Update (I think you know this already, but just covering bases): R5 is NOT doing a release; they're sending a note to staff instead. Although the press release isn't happening, OAQPS weighed in with significant edits and corrections that would be useful in drafting the note. So I'm attaching those comments here in case it's helpful to you.	06.22.18 1.58pm FW Draft news release for Source P 06.22.18 1.58pm FW Draft news release for Source Q 06.22.18 1.58pm DRAFT Press Release. Source R
6/22/18 5:07PM	Subject: RE: Willowbrook Air Monitoring Data To/From: Ed Nam writes to Erika Sasser and ccs Richard Wayland	Ed Nam writes to Erika Sasser and CCs Richard Wayward stating that the message to EPA Willowbrook office was just sent out and to limit distribution.	06.22.18 5.07pm limit distribution of EF Source S

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	Erika Sasser forwards email to Peter Tsirigotis and CCs Alison Davis and Kelly Rimer		
6/24/18 3:03PM	<u>Subject:</u> FW: Mike - can you help get Clint's OK? Draft context for R5 info on Web <u>To/From:</u> Eileen Deamer to Alison Davis, Kristen Bremer and CCs Nancy Grantham, Ed Nam, James Payne, and Kurt Thiede It is unclear who sent the email to Mike Koerber; but Mike Koerber forwards the email to Clint Woods. Mike Koerber then forwards Clint's response to Alison Davis, Eileen Dreamer, and Kristen Bremer.	Clint approves a blurb to be posted on Sterigenics website. (b) (5) [redacted]	PDF 06.24.18 3.03pm R5 website posting info.p Source T
8/1/2018 2.08PM	<u>Subject:</u> FW: ATSDR Letter Health Consultation for Sterigenics <u>To/From:</u>	On July 26, 2018, Mark Johnson writes to Ed Nam: "Here is the ATSDR Letter Health Consultation for Sterigenics, prepared by Michelle Colledge, as requested by ARD. It has been cleared by our agency and has incorporated recent comments from ARD staff. Let me know if you have any questions.	PDF 8.1.18 2.08pm Email thread.pdf Source BG

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Mark Johnson to Ed Nam, Kathryn Siegel, Alexis Cain, George Bollweg and cc Michelle Colledge	We will be distributing this letter to our colleagues at the Illinois Department of Public Health. Feel free to share with your agency partners.”	8.1.18 2.08pm ATSDR Sterigenics Et(
Ed Nam to Doug Ballotti, Thomas Short, Cheryl Newton, and Jeff Kelley, and cc Kathryn Siegel	Ed Nam forwards the email to Doug Ballotti, Thomas Short, Cheryle Newton, and Jeff Kelley stating: “As I mentioned at the 11AM, we just received this letter from ATSDR about the Sterigenics facility and the area. I understand now that they are going to post this on their website sometime next week (b) (5) [redacted]	Source BH 8.1.18 208pm (b) (5) [redacted]
Jeff Kelley to Nancy Grantham		Source BI 8.1.18 2.08pm (b) (5) [redacted]
Nancy Grantham to Alison Davis	Jeff Kelly forwards the email to Nancy Grantham. Nancy Grantham forwards the email to Alison Davis with attachment for (b) (5) [redacted] asking Alison Davis if she can speak with her and Jeff at 3pm EST and says (b) (5) [redacted]	Source BJ 8.1.18 2.08pm FW ATSDR Letter Health ((Not included as a source as it contains the same information as Source BG)

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8/19/18 2:29PM	<u>Subject:</u> Re: updated - simple messages for risk communication <u>To/From:</u> Penny Lassiter to Alison Davis and ccs Mike Koerber, Kelly Rimer, and Erika Sasser	Penny Lassiter writes to Alison Davis and ccs Mike Koerber, Kelly Rimer, and Erika Sasser: (b) (5) [redacted] Alison Davis replies to all: “That's an important point, and one I'll try to work in. Perhaps we can add it as a Q at the end.”	08.19.18 2.29pm simple messages for r Source U
8/19/18 3:30PM	<u>Subject:</u> Pager - USE THIS ONE PLEASE <u>To/From:</u> Alison Davis to Mike Koerber and ccs Kelly Rimer, and Kristen Bremer	Alison Davis sends (b) (5) [redacted] ” to Mike Koerber, Kelly Rimer, and Kristen Bremer with (b) (5) [redacted] The word document has many bullets including: • (b) (5) [redacted]	8.19.19 3.30pm One Pager on EtO regior (not added as a source as it contains the same information as Source V but in .msg file format) 08.19.18 3.30pm (b) (5) [redacted] Source V 08.19.18 3.30pm (b) (5) [redacted] Source W

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		(b) (5) [redacted]	
8/21/18 **6:03PM**	<u>Subject:</u> RE: Approved Desk Statement <u>To/From:</u> Nancy Grantham to Jeff Kelley and CCs Isabel DeLuca, John Millett, and Alison Davis. Jeff Kelley sends the version of the desk statement attached as Source O to Nancy Grantham and CCs Isabel DeLuca, John Millett, and Alison Davis.	Nancy Grantham writes to Jeff Kelley and CCs Isabel DeLuca, John Millett, and Alison Davis: "Jeff .. please use this to re-draft your desk statement for sterigenics -- looping Isabel, John and Alison -- as John Konkus will need to know that Clint or Bill have approved it." Jeff Kelley replies to Nancy stating "Attached version is a "mash up" of the HQ NATA desk statement and the R5 Sterigenics statement." The 'mash up' version is attached in this workpaper as Source O.	08.21.18 6.03pm RE Approved Desk Stater (not added as a source as it contains the same information as Source X but in .msg file format) 08.21.18 6.03pm RE Approved Desk Stater Source X 08.21.18 6.03pm 20180821-Sterigenics Source BD
8/22/18 **9:21AM**	<u>Subject:</u> RE: Emerging Health Concern in Region 6 -ATSDR Health Consult on Ethylene Oxide <u>To/From:</u>	On 8/21/18 Patrick Young, ATSDR Region 6 Regional Representative sends the following email to Region 6 Poison Control Center Directors and State Health Representatives: (b) (5) [redacted]	8.22.18 9.21am (b) (5) [redacted] Source BK

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Patrick Young sends an email to 27 members of the Region 6 Poison Control Center Directors and State Health Representatives list and ccs Alison Davis, Michael Morton (EPA), David Gray (EPA), Paula Selzer (EPA), Diane Taheri (EPA), and Jennifer Lyke (ATSDR)	(b) (5) [redacted]
Patrick Young sends a follow-up email to the same group above Alison Davis emails Paula Selzer individually	(b) (5) [redacted]
Paula Selzer replies to Alison Davis	(b) (5) [redacted] [redacted] [redacted]

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(b) (5)

[redacted]

(b) (5)

[redacted]

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(b) (5) [redacted] "

On 8/22/18 Patrick Young follows-up with another email:

(b) (5) [redacted]

[redacted]

[redacted]

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concerns to should be developed and universally shared. Poison
(b) (5) [redacted]

8/22/18 9:51AM	Subject: Re: R5 Web Language To/From: Kelly Rimer to Alison Davis	Kelly Rimer writes to Alison Davis: (b) (5) [redacted]	08.22.18 9.51am Kelly Rimer Alison Da Source Y

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8/22/18 3:19PM	<u>Subject:</u> Hi - would you give me a call? <u>To/From:</u> Alison Davis to Nancy Grantham	Blank email message from Alison Davis to Nancy Grantham one hour after NATA was posted live.	08.22.18 3.19pm Alison requesting Call Source Z
8/22/18 5:40PM	<u>Subject:</u> FW: Draft Employee email re Sterigenics <u>To/From:</u> Jeff Kelley to Nancy Grantham and Kurt Thiede Nancy Grantham forwards email to Alison Davis	Jeff Kelley writes to Nancy Grantham and Kurt Thiede: "(b) (5) [redacted] Note that Jeff Kelley writes "(b) (5) [redacted]	08.22.18 5.40pm Stopped corresponde Source AA 08.22.18 1.51pm Comments on draft m Source AB
8/24/18 8:15PM	<u>Subject:</u> (b) (5) [redacted] <u>To/From:</u> Alison Davis to Mike Koerber	Alison Davis sends (b) (5) [redacted] to Mike Koerber	PDF 8.24.18 8.15p (b) (5) [redacted] Source AC

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8/29/18 **9:52AM**	<u>Subject:</u> RE: ATSDR statement about the Health Consultation for the Sterigenics facility <u>To/From:</u> Mark Johnson to Mayor Frank Trilla, and Lissa Druss from Serafin & Associates Inc. and cc's Michelle Colledge (EPA) Mayor Trilla to Tim Halik and Robert Schaller Tim Halik replies to all Lissa Druss to Tim Halik, Robert Schaller and Lissa Druss. Tim Halik replies to all Lissa Druss to Jeff Kelley, Tim Halik, Mayor Frank Trilla, Tom Bastian, Robert Schaller, and Colleen Dugeon Jeff Kelley to Ed Nam, Mark Johnson, Kurt Thiede, James Payne, Cathy Stepp, Kathryn	Mark Johnson, Regional Director of ATSDR, emails Mayor Frank Trilla of Willowbrook and writes: "Here is the statement that we have been working on at CDC/ATSDR to provide some additional context for the public regarding the Health Consultation document for the Sterigenics facility in Willowbrook. As mentioned in the statement, this was a technical document that was intended to inform and support regulatory agency actions by USEPA and Illinois EPA to reduce emissions from this facility, rather than a direct communication to the general public. Hopefully, this statement will clarify some aspects of our report. Feel free to use the information as you find beneficial to your community. We are committed to answering any health-related questions from your office and from residents of Willowbrook." Mayor Trilla forwards the email to Tim Halik, Village Administrator, and Robert Schaller and writes: "It's important you read the text in the email from Mark Johnson." Tim Halik responds "OMG!....we should publish his email!" Lissa Druss replies from Frank Trilla's email to Tim Halik, Robert Schaller and cc's herself and writes: "Tim, this is Lissa sitting here with Mayor Trilla. We will bring this up with Mark Johnson tomorrow on the phone before we consider publishing it. Please think of questions for the federal agencies. We are giving them a list tomorrow and will have a briefing call Wednesday morning. Tim Halik replies with a list of several questions. Lissa Druss sends the questions to Jeff Kelley (EPA) and other. Jeff Kelley forwards the questions to Ed Nam and others	PDF 8.29.18 9.52am ATSDR letter taken dc Source BL

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	Siegel, Rachel Bassler, and Nancy Grantham Kathryn Siegel to Jeff Kelley, Ed Nam, Mark Johnson, Michelle Colledge, Eileen Furey, Rachel Bassler, Alison Davis, Kelly Rimer, Kristen Bremer, Jan Cortelyou-Lee Mark Johnson to Kathryn Siegel, Jeff Kelley, Ed Nam, Michelle Colledge, Eileen Furey, Rachel Bassler, Alison Davis, Kelly Rimer, Kirsten Bremer, Jan Cortelyou-Lee	Kathryn Siegel sends an email to Jeff Kelley and others and writes: "I think that we should have a quick coordination call this morning to discuss who is working on what. How's 9:15am Central?" Mark Johnson replies and writes "That's fine with ATSDR"	
8/29/18 12:20PM	<u>Subject:</u> RE: ATSDR statement about the Health Consultation for the Sterigenics facility <u>To/From:</u> Mark Johnson to Kathyrn Siegal, Jeff Kelley, Ed Nam, Michelle Colledge, Eileen Furey, Rachel Bassler, Alison Davis, Kelly Rimer, Kirsten Bremer, Jan Cortelyou-Lee	Mark Johnson writes to Kathryn Siegal, Jeff Kelley, Ed Nam, Michelle Colledge, Eileen Furey, Rachel Bassler, Alison Davis, Kelly Rimer, Kirsten Bremer, Jan Cortelyou-Lee: "Here are ATSDR inserts in the response" and attaches a Word document. (b) (5) [redacted]	PDF 8.29.18 12.20pm ATSDR letter taken dc Source BM 8.29.18 12.20pm CityofWillowbrook_Q Source BN

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(b) (5)

[redacted]

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		(b) (5) [redacted]	
8/29/18 1:26PM	<u>Subject:</u> RE: ATSDR statement about the Health Consultation for the Sterigenics facility <u>To/From:</u> Kathryn Siegel to Michelle Colledge , Mark Johnson, Kathyrn Siegal, Jeff Kelley, Ed Nam, Eileen Furey, Rachel Bassler, Alison Davis, Kelly Rimer, Kirsten Bremer, Jan Cortelyou-Lee and ccs Darcie Smith	Kelly Rimer replies to all and writes "Here is our answer to the general risk question. This may or may not be what they are asking in the first question. (b) (5) [redacted]	PDF 8.29.18 1.26pm ASTDR questions ansv Source BO W 8.29.18 1.26pm CityofWillowbrook_Q Source BP

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		(b) (5) [redacted] Kathryn Siegel replies to all and attaches a document titled "CityofWillbrook_Q&A_8.29". Kathryn Siegel writes: "For those that don't have access to SharePoint, attaching a copy of what has been incorporated so far. Kelly and Michelle, I will insert your additions after the call. Thanks and talk soon!"	
9/10/18 9:25AM	<u>Subject:</u> Re: (b) (5) [redacted] <u>To/From:</u> Eileen Deamer to Alison Davis	Email from Eileen Deamer stating tha (b) (5) [redacted]	09.10.18 9.25am (b) (5) [redacted] pdf Source AD
9/14/18	No relevant or significant emails found		
9/26/18 8:14AM	<u>Subject:</u> FW: Updated language on ETO and IRIS assessment <u>To/From:</u> Mike Koerber to Kely Rimer, Darcie Smith, Kristen Bremer,	Mike Koerber sends an email stating that Clint would like to provide OCIR with a document, that might be a public document, to respond to inquiries. Most of the information on the document is now online on EPA's [Frequently Asked Questions on Ethylene Oxide page]()	9.26.18 8.14am FW Updated language on (not added as a source as it contains the same information as Source

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	Alison Davis, Jan Cortelyou-Lee, and CC Patrick Lessard		AE but in .msg file format) 9.26.18 8.14am FW Updated language on Soure AE 09.26.18 8.14am Background Materials Source AF
9/26/18 11:01AM	<u>Subject:</u> RE: The urgent Sterigenics question in DuPage: How much cancer risk? - Chicago Tribune <u>To/From:</u> Nancy Grantham to Alison Davis	Nancy Grantham writes to Alison Davis: "Can you call me asap thanks ng"	09.26.18 11.01am Nancy requests Call w Source AG
9/26/18 11:19AM	<u>Subject:</u> Re: Noon <u>To/From:</u> Alison Davis to Nancy Grantham	Alison sends to Nancy Grantham "Spoke with Kirsten-she will alert Kelly", Nancy says "Stand by...need to talk with clint"	09.26.18 11.19am Noon.pdf Source AH

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9/26/18 1:31PM	<u>Subject:</u> call me? It's kind of urgent. <u>To/From:</u> Isabel DeLuca to Alison Davis	Blank email from Isabel DeLuca from Office of Air Radiation to Alison Davis	09.26.18 1.31pm Isabel DeLuca request Source AI
9/26/18 2:06PM	<u>Subject:</u> [redacted] <u>To/From:</u> Isabel DeLuca to Clint Woods, Alison Davis, Mike Koerber, and John Millett	Isabel DeLuca sends an email to Clint Woods, Alison Davis, Mike Koerber, and John Millett stating "Hi Clint and team, [redacted]	[redacted] (not added as a source as it contains the same information as Source AJ but in .msg file format) 09.26.18 2.06pm [redacted] Source AJ 09.26.18 2.06pm [redacted] Source AK
9/26/18 2:16PM	<u>Subject:</u> FW: Letter re: Willowbrook Ambient Air Testing <u>To/From:</u> David Applegate from Senator Tammy Duckworth's	Matthew Davis forwards a congressional letter that is written to EPA Administrator Wheeler and then Region 5 Administrator Stepp that says that Congress would like EPA to make ambient air monitoring data and stack testing data on Sterigenics publicly available and to "provide explanation for who decided, and why, to remove a one-pager providing context for the ATSDR report from the R5 website after only an hour or two."	09.26.18 2.16pm Congressoinal Inquiry Source AL

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	office sends the original email to Eileen Deamer, Matthew Davis Matthew Davis forwards it to Troy Lyons, Aaron Ringel, Christian Palich, and CC Christian Rodrick, Tony (Robert) Frye, and Patricia Haman It is unclear who sent the email to Jackie Ashley Jackie Ashley from OAQPS sends email to Mike Koerber, Alison Davis, Kristen Bremer, Erika Sasser, and CCs Sara Terry.		09.26.18 2.16pm 18.09.21 - Letter re W Source AM
9/26/18 4:50PM	<u>Subject:</u> FW: Letter <u>To/From:</u> Nancy Grantham to RobinH Richardson, Matthew Davis, Karen Thundiyil, Jack Bowles, and CC Alison Davis, Kristen Bremer, John Millett, Isabel DeLuca, Nancy Grantham	Nancy Grantham forwards letter from Illinois EPA to US EPA dated September 25, 2018 requesting that US EPA conduct ambient air monitoring as recommended by ATSDR.	09.26.18 4.50pm Attached letter from Il Source AN 9.26.18 4.50pm Email Thread.pdf

Prepared by:	**Date**
Gaida Mahgoub	2/13/2020
Approved by:	**Date**
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			Source BF 09.26.18 4.50pm FW Letter.msg (not added as a source as it contains the same information as Source BF but in .msg file format)
9/27/18 1.46PM	<u>Subject:</u> FW: R5 <u>To/From:</u> Clint Woods to Mike Koerber Mike Korber forwards message to Kirsten Bremer, Alison Davis, and Kelly Rimer	Clint Woods writes to Mike Koerber: "Attached is pdf of R5 website, which we had asked to reformat for national consistency. Can you take a look for content red flags or formatting changes we would suggest? Trying to get on read on whether this is a short term ask (post the pdf) or something where we could day a couple days to tighten up the page to match previous R6-type sites."	09.27.18 1.46pm FW R5.msg (not added as a source as it contains the same information as Source AO but in .msg file format) 09.27.18 1.46pm FW R5.pdf Source AO 09.27.18 1.46pm Sterigenics_8.22 web Source AP

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Gaida Mahgoub	2/13/2020
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Renee McGhee-Lenart	2/18/2020

9/27/18 **5:13PM**	<u>Subject:</u> Re R5 <u>To/From:</u> Kristen Bremer replies to Mike Koerber, Alison Davis, and CCs Kelly Rimer Mike Koerber then emails Kirsten Bremer, Alison Davis, and Clint Woods and CCs Kelly Rimer	Kirsten Bremer Replies All to the email mentioned above at 1:46pm [redacted] (b) (5) Mike Koerber Replies All and provides an example of formatting of a Region 6 page that would "provide a good model for this Region 5 page"	09.27.18 5.13pm link to a R6 page.pdf Source AQ 09.27.18 5.13pm Webpage LaPlace, St. Source AR
9/28/18 **11:16 AM**	<u>Subject:</u> Re: Today's call <u>To/From:</u> Alison Davis to Ed Nam Mike Koerber replies to Ed Nam and CC's Alison Davis, Kelly Rimer, and Kirsten Bremer	Alison says "Hi Ed, A couple of us would like to listen (listen only) to today's call, if you think that's appropriate. If you're OK with that, would you share the #? Thanks." Ed says "I'll leave that to Mike. I was told that the audience was being restricted." Mike says "Yes, please share with Alison". Ed shares phone line	9.28.18 11.16am RE Today's call.pdf Source AS
10/17/18 **4:57PM**	<u>Subject:</u> Agenda: Bill Wehrum Visit to EPA RTP <u>To/From:</u> Patrick Lessard sends an email to two email groups:	This email contains a table of the schedule for an all-day meeting with documents embedded for various discussion topics. Bill Wehrum is on the agenda and documents for his EPA RTP visit on 10/18 attached in this email	10.17.18 4.57pm Agenda Bill Wehrum (not added as a source as it contains the same information as Source

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	OAQPS SMT1 and OAQPS SMT2 and CC's Voronina McKinney and Mike Koerber		AT but in .msg file format) 10.17.18 4.57pm Agenda Bill Wehrum \ Source AT
10/17/18 5:07PM	Subject: EtO mailbox-update To/From: Alison Davis to Mike Koerber, ccs Kelly Rimer and Kristen Bremer	Alison Davis writes: "Mike – Nancy Grantham has offered to have her intern respond from the EtO mailbox. (The intern also tracks emails to the Administrator.) I am taking her up on that, so no need to raise that with Clint. I would like to make sure he's aware of the OCIR approach - we review, they answer – and to be sure he is OK with that. "	10.17.18 5.07pm EtO mailbox update.pdf Source BC
10/18/18 11:11AM	Subject: Re: Sterigenics US LLC To/From: John J. Kim, Chief Legal Counsel of Illinois EPA sends an email to Richard Wayward on October 11, 2018 at 2:25pm. Richard Wayward forwards the email but the recipient is not noted. Next, Peter Tsirigotis sends an email to Richard Wayward and CC's	Illinois EPA and Illinois Attorney General's office are interested in a phone call with EPA to better understand " the scope and parameters of modeling to be done based on recent stack test results from the Sterigenics facility in Willowbrook, Illinois" OAQPS would like to fold in Clint and OGC on the topic. Richard Wayward from OAQPS says "He called me again yesterday and I told him Clint had reached out to his boss in IL EPA and that further conversations would not come until after their boss had reviewed the 1-pager we sent up to Clint. So the ball is back in their court at this point. No action for us at this point. "	10.18.18 11.11am Sterigenics US LLC Illr Source AU

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Renee McGhee-Lenart	2/18/2020

	Mike Koerber, David Cozzie, Kelly Rimer, Lewis Weinstock, Ned Shappley		
10/31/18 9:57AM	<u>Subject:</u> Monitoring Plan for Willowbrook - Call in number (b) (5), (b) (6) [redacted] <u>To/From:</u> Calendar invite sent by Kelly Rimer to Mike Koerber, Ned Shappley, Lewis Weinstock, Tim Halik, Mayor Mickey, Mayor Kathleen Weaver of the Village of Darien and two individuals with the email addresses: bvana@darenil.gov and kgargano@villageofhinsdale.org The invite also included Darcie Smith, Kristen Bremer, Alison Davis, Laura McKelvey, James Thurman, and Mark Morris	Meeting Scheduled by Kelly Rimer for 3pm-4pm on October 31, 2018 (b) (5) [redacted]	10.31.18 9.57am Scheduled Call Monit (not added as a source as it contains the same information as Source AV but in .msg file format) 10.31.18 9.57am Scheduled Call Monit Source AV
11/6/18 1:40PM	<u>Subject:</u> EtO Coordination ATSDR EPA <u>To/From:</u>	Meeting scheduled with Mark Johnson, ATSDR Region 5 Senior Representative, and EPA staff. Meeting is scheduled for November 19, 2018 by Kelly Rimer who wrote in the meeting invitation: "Purpose: To Prepare for Community Meeting. This is the second of 2 meeting on the topic."	11.6.18 1.40pm Meeting scheduled fo

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Gaida Mahgoub	2/13/2020
Approved by:	**Date**
Renee McGhee-Lenart	2/18/2020

	Meeting invite sent by Kelly Rimer to Darcie Smith, Mark Johnson, Amy Vasu, Kristen Bremer, Alison Davis, Laura McKelvey		(not added as a source as it contains the same information as Source AW but in .msg file format) 11.6.18 1.40pm Meeting scheduled fo Source AW
11/7/18 2:05PM	<u>Subject:</u> FW: DURBIN CALLS FOR INVESTIGATION INTO TRUMP ADMINISTRATION'S DELAY OF NOTIFYING LAKE COUNTY RESIDENTS ABOUT CANCER-CAUSING POLLUTION <u>To/From:</u> Alison Davis to Clint Woods and Isabel DeLuca	John Konkus says to Clint Woods, Jeff Kelley, Kurt Thiede, Cathy Stepp: (b) (5) [redacted] Alison sends to Clint Woods: "Hi Clint, Just a heads up that John Konkus and Jeff Kelley looped us into an inquiry from Michael Hawthorne, who is asking about a response to the press release below. We are going to work on an answer that focuses on the NATA process. Once we have the draft, we'll send up for your review before we send to John. Look for something between 330 and 4. " (b) (5) [redacted]	11.07.18 2.05pm Working with states n Source AX
11/7/18 2:06PM	<u>Subject:</u> Re: URGENT: Press Deadline 3.30pm <u>To/From:</u> Alison Davis to Mike Koerber	Mike Koerber says to Alison "We need to talk--what is your phone number" Alison sends (b) [redacted]	11.07.18 2.06pm Mike wants to talk to Source AY

Prepared by:	**Date**
Gaida Mahgoub	2/13/2020
Approved by:	**Date**
Renee McGhee-Lenart	2/18/2020

11/8/18 10:50AM	Subject: RE: Confidential To/From: Source AZ: Email thread between Alison Davis and Jeff Whitlow Source BE: Peter Tsirigotis forwards message from Bill Wehrum to Scott Monroe	Alison says "I would like to tell my team at noon, what do you think". Jeff Whitlow says "No go for today" Alison says "any sense of when Peter plans to send the email". Jeff says " He's checking to see if Wehrum wants to send it. Maybe tomorrow or Tuesday". Alison says she prefers Tuesday Source BE is the announcement of Mike Koerber being selected as Deputy Director of OAQPS, sent by Bill Wehrum and Forwarded by Peter Tsirigotis to Scott Monroe	PDF 11.8.18. 10.50am no go for Deputy annour Source AZ PDF 11.13.18 4.01pm OAQPS Koerber as De Source BE
11/9/18	No significant emails found		
2/13/19 2:23PM	Subject: FW: Follow up To/From: Thread between Jennifer McConahy and Laura McKelvey Laura McKelvey sends email to EtO mailbox, Mike Koerber, Lewis Weinstock, Alison Davis, Kristen Bremer, Holly Wilson, and Pam Long	Jennifer McConahy sends from a gmail account asking Laura "Checking to see if there were any updates from your meeting. I was also hoping to get the specific wording of 114 letter. " Laura replies with a govinfo.gov link and says "I was able to ask Mike this morning and he said the meeting went well and the facility was cooperative and provided the data that we and the state requested"	PDF 02.13.19 2.23pm Followup on 114 lette Source BA

Prepared by:	Date
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Approved by:	**Date**
Renee McGhee-Lenart	2/18/2020

Reviewer Comment (and Date of Review)	Team Response (and Date of Response)	Resolution (and Date of Resolution)
Comments made in previous versions emailed to the Project Manager.		WP is approved. RML 2/18/20

Prepared by:	Date
Gaida Mahgoub	2/13/2020
Approved by:	**Date**
Renee McGhee-Lenart	2/18/2020

Sterigenics Willowbrook Facility

On this page

Update – August 2018

In May 2018, U.S. Environmental Protection Agency conducted air monitoring and, upon receiving the lab results in June, found elevated levels of the chemical ethylene oxide in the air near the Sterigenics International Inc. facility at 7775 S. Quincy St., Willowbrook, Ill. The agency took immediate steps to reduce the emissions and to determine if they presented a risk to the public.

In June, U.S. EPA requested that the federal Agency for Toxic Substances and Disease Registry (a part of the Centers for Disease Control and Prevention) determine whether the emissions presented a public health risk. ATSDR's July analysis(PDF) (19pp, 2MB, About PDF) shows an elevated cancer risk exists for residents and off-site workers in the Willowbrook community surrounding the Sterigenics facility, assuming chronic or long-term exposure to the levels of ethylene oxide found during U.S. EPA's short-term sampling.

U.S. EPA is working with Illinois EPA and Sterigenics to reduce emissions of ethylene oxide from the company's facility. Sterigenics uses ethylene oxide to sterilize medical equipment and other products. In July, the company installed additional pollution controls to capture ethylene oxide emissions. U.S. EPA and Illinois EPA will monitor the effectiveness of the new equipment to determine whether any other actions are needed to protect public health.

U.S. EPA is committed to keeping the Willowbrook community informed and will post updates to this information on this website.

Background

What is Ethylene Oxide (EtO)?
Ethylene oxide is a flammable, colorless gas used to make a range of products, including antifreeze, textiles, plastics, detergents and adhesives. EtO also is used to sterilize equipment and plastic devices that cannot be sterilized by steam, such as medical equipment. The Clean Air Act lists EtO as a Hazardous Air Pollutant.

In December 2016, U.S. EPA updated its risk value for ethylene oxide. U.S. EPA classified EtO as "carcinogenic to humans," based on strong evidence from studies of workers and other studies. Studies of workers show that exposure to EtO is associated with an increased risk of cancers of the white blood cells and, in females, breast cancer.

What is Sterigenics?
Sterigenics is a commercial sterilizer that uses EtO to sterilize medical equipment and other products. It has been operating in Building 1 (7775 Quincy Street) since 1984 and in Building II (830 Midway) since 1999. It is owned by Sterigenics International LLC, which operates nine EtO sterilization facilities in the United States. The facility currently operates under a Clean Air Act permit issued by Illinois EPA in 2015.

Why is U.S. EPA involved?
In December of 2016, U.S. EPA completed a reevaluation of EtO inhalation carcinogenicity. The 2016 evaluation revised the classification of EtO from a "probable human carcinogen" to "carcinogenic to humans." It also increased U.S. EPA's estimate of EtO chronic inhalation cancer potency. As a result, U.S. EPA began to examine potential risks caused by large emitters of EtO. As part of this effort, U.S. EPA Region 5 conducted a preliminary analysis of EtO emissions from Sterigenics in Willowbrook, Illinois.

What Do We Know?

What air monitoring has been conducted?
In late 2017, U.S. EPA Region 5 modeled EtO emissions from Sterigenics. The modeling suggested there could be elevated levels of EtO near the facility. As a result, U.S. EPA conducted short-term canister air sampling for three days in mid-May of 2018 to determine whether EtO could be detected using U.S. EPA's Method TO-15 and at what levels, if any, it was present in the ambient air. The short-term sampling confirmed that U.S. EPA's Method TO-15 is capable of measuring EtO present in the ambient air in close proximity to the Willowbrook facility. While this method was capable of measuring the EtO concentrations observed during the short-term sampling period, this technique is not sensitive enough to measure levels of EtO below a certain threshold.

What are the monitoring results?
The links below show the levels of EtO in air samples collected at each monitoring location.

- Air monitoring results for May 16, 17 and 18, 2018
- Air monitoring map

What are the health impacts?
U.S. EPA has classified EtO as a chemical that causes cancer in humans, based on scientific studies that used both human and animal data. Learn more about EtO. Any cancer-causing chemical is potentially dangerous, but how dangerous depends on the toxicity of the chemical, what concentration a person is exposed to, and for how long that person is exposed. For EtO, our primary concern is people being exposed to concentrations associated with elevated cancer risk for many years. The greatest risk is for people who are exposed to concentrations associated with elevated cancer risk for their entire lifetime.

Evidence in humans indicates that exposure to EtO increases the risk of cancers of the white blood cells (including non-Hodgkin lymphoma, myeloma, and lymphocytic leukemia) and, for females, breast cancer.

What is the difference between an acute risk and a chronic risk?
When estimating cancer risk, U.S. EPA typically assumes a 70-year "chronic" exposure. "Acute" is another way to say short-term exposure. Acute exposure to high concentrations of EtO in air can cause headache, dizziness, nausea, fatigue, respiratory irritation (e.g., coughing, shortness of breath, wheezing) and, in some cases, vomiting and other types of gastrointestinal distress. To protect against acute impacts, U.S. EPA has Acute Exposure Guideline Levels (AEGLs) that are intended to protect most individuals in the general population, including those who might be particularly susceptible to the harmful effects of the chemicals.

- The 1-hour AEGL-2 for EtO is 81,000 µg/m3.
- The 8-hour AEGL-2 is 14,000 µg/m3.

The Agency for Toxic Substances and Disease Registry (ATSDR) has established screening levels (Minimal Risk Levels, or MRLs) for intermediate inhalation risks. The MRLs are for exposures of 14 to 365 days, and are set below levels expected to cause adverse health effects in people most sensitive to effects. The ATSDR inhalation intermediate MRL for EtO is 160 µg/m3. The maximum modeled and measured concentrations near the Sterigenics facility are all well below these benchmarks:

- The maximum long-term average concentration modeled at a residence was 0.218 µg/m3.
- The highest 12-hour canister sample collected at a residence was 2.12 µg/m3.

How big of an area is affected? How widespread is the risk?
The data on the website presents a map of the area where the initial canister samples were taken in mid-May. The maximum distance that was sampled was about 2,000 feet from the facility, in the Willowbrook Community Park. This was an initial screening study and U.S. EPA is developing a plan to collect additional information to characterize the risk now that Sterigenics has installed additional controls.

Has there been any independent evaluation of the health risks posed by EtO emissions from Sterigenics?
U.S. EPA asked ATSDR to evaluate whether EtO air concentrations near Sterigenics pose a public health problem for people living and working in Willowbrook. ATDSR provided a response in a letter dated July 26, 2018; this evaluation was based not on current conditions, but rather on modeled and monitored EtO levels prior to the installation of additional controls. ATSDR concluded(PDF) (19pp, 2MB, About PDF): "if measured and modeled data represent typical EtO ambient concentrations in ambient air, an elevated cancer risk exists for residents and off-site workers in the Willowbrook community surrounding the Sterigenics facility. These elevated risks present a public health hazard to these populations."

ATSDR also concluded that "measured and modeled ethylene oxide concentrations in ambient air indicate that noncancer health effects are unlikely for residents and off-site workers in the Willowbrook community surrounding the Sterigenics facility."

How is U.S. EPA Responding?

What have U.S. EPA and Illinois EPA done to stop the pollution?
U.S. EPA and Illinois EPA are working with Sterigenics to reduce emissions. In June, Sterigenics submitted a construction permit application to Illinois EPA to install additional pollution controls. After review from the U.S. EPA and Illinois EPA, Illinois EPA issued the permit on June 26, 2018. Sterigenics finished installing additional pollution controls to capture EtO emissions on July 27, 2018.

What are the next steps?
Stack tests to measure current emissions are being scheduled. We believe that the controls have resulted in reductions of EtO emissions. U.S. EPA and Illinois EPA are currently working with the company to evaluate the possible need for additional action.

Documents

Documents related to the Sterigenics Willowbrook Facility site investigation

You may need a PDF reader to view some of the files on this page. See EPA's About PDF page to learn more.

Contact Information

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More Information

Ethlyene Oxide
National Air Toxics Assessment

Contact Us to ask a question, provide feedback, or report a problem.

Workpaper - OA&E-FY19-0091 EPA Actions to Address Elevated Cancer Risks from Air Toxics Emissions from Point Sources

Created By: Gaida Mahgoub 2/13/2020

Section: L.04
Subject: R1- Penny Lassiter Email Analysis
Program Name: Email Analyses

Information:

Status: In Progress **Review:**

In Progress Editors:

Current Editors: Roles: AIG_DAIG, Assigned Auditor, Audit In-Charge, Audit Manager, New employee, Product Line Director, Quality Assurance

Issues:

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Attachments:

- 01.31.19 8.12pm (b) (5) [redacted], 143888 KB, Source W, , 02/13/2020 16:18:03
- 2.11.19 7.27am (b) (5) [redacted], 97824 KB, Source X, , 02/13/2020 16:18:33
- 2.11.19 9.08am (b) (5) [redacted] Source Y, , 02/13/2020 16:22:10
- 07.30.18 12.17pm (b) (5) [redacted] 180000 KB, Source A, , 02/13/2020 14:51:35
- 8.8.18 3.38pm (b) (5) [redacted], 39984 KB, Source C, , 02/13/2020 14:52:00
- 8.8.18 3.38pm (b) (5) [redacted], 119792 KB, Source B, , 02/13/2020 14:52:23
- 08.21.18 6.33pm (b) (5) [redacted], 181680 KB, Source D, , 02/13/2020 14:52:41
- 08.22.18 12.43pm (b) (5) [redacted], 103520 KB, Source E, , 02/13/2020 14:57:18
- 9.10.18 11.41am (b) (5) [redacted], 9168 KB, Source G, , 02/13/2020 14:58:36
- 09.10.18 11.41am (b) (5) [redacted], 70000 KB, Source F, , 02/13/2020 14:58:04
- 9.17.18 2.08pm (b) (5) [redacted], 165584 KB, Source H, , 02/13/2020 14:59:03
- 9.24.18 11.02am (b) (5) [redacted], 123088 KB, Source I, , 02/13/2020 14:59:46
- 9.25.18 3.04pm (b) (5) [redacted], 177856 KB, Source K, , 02/13/2020 15:01:34
- 9.25.18 3.04pm (b) (5) [redacted] 178144 KB, Source J, , 02/13/2020 15:01:17
- 9.26.18 2.49pm (b) (5) [redacted], 138560 KB, Source M, , 02/13/2020 15:28:53

9.26.18 2.49pm [redacted] 516672 KB, Source Z, , 02/13/2020 16:20:17
9.26.18 9.03am [redacted] 89984 KB, Source L, , 02/13/2020 15:03:31
9.27.18 2.26pm [redacted] 241888 KB, Source N, , 02/13/2020 15:29:22
10.17.18 3.58pm [redacted] 39040 KB, Source R, , 02/13/2020 15:52:10
10.17.18 3.58pm [redacted], 141408 KB, Source Q, , 02/13/2020 15:51:47
10.17.18 4.05pm [redacted], 130464 KB, Source P, , 02/13/2020 15:50:58
10.17.18 12.28pm [redacted], 104432 KB, Source O, , 02/13/2020 15:50:12
10.18.18 10.56am [redacted], 104960 KB, Source S, , 02/13/2020 15:55:03
10.19.18 1.44pm [redacted], 112560 KB, Source T, , 02/13/2020 16:16:26
11.7.18 6.03pm [redacted]pdf, 141184 KB, Source U, , 02/13/2020 16:17:15
12.11.18 1.32pm [redacted], 138096 KB, Source V, , 02/13/2020 16:17:46
[redacted] 8800 KB, Default Description, , 02/13/2020 14:47:44
L.4 [redacted].docx, 4073360 KB, PSSC, , 10/06/2020 11:50:13

Approval:

Preliminary Approval, Renee McGhee-Lenart, 02/19/2020 15:09:48

History:

Gaida Mahgoub, 02/13/2020 14:47:44, Created
Gaida Mahgoub, 02/13/2020 16:22:26, Edited
Renee McGhee-Lenart, 02/19/2020 13:53:13, Edited
Renee McGhee-Lenart, 02/19/2020 15:09:48, Preliminary Approval
Renee McGhee-Lenart, 02/19/2020 15:09:51, Edited
Renee McGhee-Lenart, 02/19/2020 15:10:15, Edited

Workpaper - OA&E-FY19-0091 EPA Actions to Address Elevated Cancer Risks from Air Toxics Emissions from Point Sources

Created By: Gaida Mahgoub 3/3/2020

Section: L.05
Subject: R1--Peter Tsirigotis Email Analysis
Program Name: Email Analyses

Information:

Status: In Progress **Review:**

In Progress Editors:

Current Editors: Roles: AIG_DAIG, Assigned Auditor, Audit In-Charge, Audit Manager, New employee, Product Line Director, Quality Assurance

Issues:

Comments:

Attachments:

2.16.18 6.27am (b) (5) [redacted]pdf, 141376 KB, Source AI, , 03/06/2020 15:49:52
2.16.18 8.53am (b) (5) [redacted] 93888 KB, Source AG, , 03/06/2020 15:48:45
2.16.18 8.53am (b) (5) [redacted] 145104 KB, Source AF, , 03/06/2020 15:47:31
02.16.19 1.55pm (b) (5) [redacted], 144016 KB, Source AH, , 03/06/2020 15:49:14
2.16.19 12.19pm (b) (5) [redacted], 146688 KB, Source AJ, , 03/06/2020 15:50:08
2.18.18 9.28am (b) (5) [redacted], 342960 KB, Source AK, , 03/06/2020 15:50:22
6.21.18 1.34pm (b) (5) [redacted], 109984 KB, Source C, , 03/04/2020 15:55:56
6.21.18 1.34pm (b) (5) [redacted], 830928 KB, Source D, , 03/04/2020 15:57:23
6.21.18 1.34pm (b) (5) [redacted], 1194512 KB, Source B, , 03/04/2020 15:44:58
06.21.18 9.16pm (b) (5) [redacted] 138800 KB, Source E, , 03/04/2020 16:03:41
06.21.18 11.36am (b) (5) [redacted], 102896 KB, Source A, , 03/04/2020 15:40:16
6.22.18 4.51pm (b) (5) [redacted], 491104 KB, Source G, , 03/04/2020 16:47:01
6.22.18 4.51pm (b) (5) [redacted], 712416 KB, Source F, , 03/04/2020 16:46:34
7.24.18 2.38pm (b) (5) [redacted], 7136 KB, Source I, , 03/04/2020 16:48:29
7.24.18 2.38pm (b) (5) [redacted], 69760 KB, Source H, , 03/04/2020 16:47:30
7.25.18 7.49pm (b) (5) [redacted] 145696 KB, Source J, , 03/06/2020 10:41:18

7.25.18 7.49pm (b) (5) [redacted], 19040 KB, Source K, , 03/06/2020 10:42:48
7.26.18 2.00pm (b) (5) [redacted], 1605152 KB, Source P, , 03/06/2020 11:02:53
7.26.18 2.00pm (b) (5) [redacted], 1758080 KB, Source O, , 03/06/2020 11:02:35
7.26.18 8.04 am (b) (5) [redacted] 96848 KB, Source L, , 03/06/2020 10:46:15
7.26.18 8.04am (b) (5) [redacted], 14320 KB, Source M, , 03/06/2020 10:46:38
7.26.18 9.25am (b) (5) [redacted], 177552 KB, Source N, , 03/06/2020 11:02:10
8.20.18 5.52pm (b) (5) [redacted] 118080 KB, Source Q, , 03/06/2020 11:11:52
9.7.18 7.59pm (b) (5) [redacted], 68944 KB, Source R, , 03/06/2020 11:15:43
9.7.18 8.40am (b) (5) [redacted], 69568 KB, Source S, , 03/06/2020 11:18:59
9.7.18 8.42pm (b) (5) [redacted], 8240 KB, Source T, , 03/06/2020 11:20:09
9.7.18 8.42pm (b) (5) [redacted], 69600 KB, Source U, , 03/06/2020 11:20:51
9.14.18 4.25pm (b) (5) [redacted], 145280 KB, Source V, , 03/06/2020 11:24:10
10.17.18 7.42am (b) (5) [redacted] 177584 KB, Source W, , 03/06/2020 11:34:41
10.26.18 6.56pm (b) (5) [redacted], 41840 KB, Source Y, , 03/06/2020 11:35:40
10.26.18 6.56pm (b) (5) [redacted], 143280 KB, Source X, , 03/06/2020 11:35:26
11.8.18 7.36 (b) (5) [redacted], 91344 KB, Source Z, , 03/06/2020 11:36:08
11.9.18 9.53am (b) (5) [redacted], 122368 KB, Source AA, , 03/06/2020 11:36:47
11.9.18 10.38am (b) (5) [redacted] 101072 KB, Source AD, , 03/06/2020 15:33:26
11.9.18 10.38am (b) (5) [redacted], 37328 KB, Source AB, , 03/06/2020 11:39:53
11.9.18 10.38am (b) (5) [redacted] 135664 KB, Source AC, , 03/06/2020 11:45:54
11.11.18 3.59pm (b) (5) [redacted], 94368 KB, Source AE, , 03/06/2020 15:46:45
Document1.docx, 8800 KB, Default Description, , 03/03/2020 16:56:51
(b) (5) [redacted] .docx, 11696800 KB, PSSC, , 03/18/2020 16:21:39

Approval:

Preliminary Approval, Renee McGhee-Lenart, 03/18/2020 08:50:46

History:

Gaida Mahgoub, 03/03/2020 16:56:51, Created
Gaida Mahgoub, 03/04/2020 15:53:43, (b) (5) [redacted]
Gaida Mahgoub, 03/06/2020 11:40:29, (b) (5) [redacted]
Renee McGhee-Lenart, 03/18/2020 08:50:46, Preliminary Approval

Workpaper - OA&E-FY19-0091 EPA Actions to Address Elevated Cancer Risks from Air Toxics Emissions from Point Sources

Created By: Gaida Mahgoub 2/20/2020

Section: L.06
Subject: R1--Kurt Thiede Email Analysis
Program Name: Email Analyses

Information:

Status: In Progress **Review:**

In Progress Editors:

Current Editors: Roles: AIG_DAIG, Assigned Auditor, Audit In-Charge, Audit Manager, New employee, Product Line Director, Quality Assurance

Issues:

Comments:

Attachments:

6.22.18 8.31am (b) (5) [redacted].pdf, 236944 KB, Source A, , 02/20/2020 11:56:27
06.22.18 8.37am (b) (5) [redacted].pdf, 105568 KB, Source B, , 02/20/2020 11:56:45
6.22.18 8.46am (b) (5) [redacted], 9248 KB, Source C, , 02/20/2020 11:57:03
6.22.18 8.46am (b) (5) [redacted], 69360 KB, Source D, , 02/26/2020 11:56:39
8.21.18 5.38pm (b) (5) [redacted], 13200 KB, Source AO, , 02/21/2020 14:22:05
08.21.18 5.38pm (b) (5) [redacted], 200704 KB, Source E, , 02/20/2020 12:01:00
8.21.18 6.29pm (b) (5) [redacted], 13872 KB, Source AP, , 02/21/2020 14:22:16
08.21.18 6.29pm (b) (5) [redacted], 203456 KB, Source F, , 02/20/2020 12:11:45
8.21.18 9.50pm (b) (5) [redacted], 491088 KB, Source H, , 02/20/2020 12:12:17
8.21.18 9.50pm (b) (5) [redacted].pdf, 158848 KB, Source G, , 02/20/2020 12:13:43
8.22.18 9.12pm (b) (5) [redacted], 146208 KB, Source K, , 02/20/2020 16:38:21
8.22.18 12.09pm (b) (5) [redacted] 13360 KB, Source J, , 02/20/2020 16:34:42
8.22.18 12.09pm (b) (5) [redacted], 197344 KB, Source I, , 02/20/2020 16:33:38
8.23.18 8.07am (b) (5) [redacted] 15552 KB, Source L, , 02/20/2020 16:57:11

8.23.18 8.07am(b) (5) [redacted].pdf, 192896 KB, Source M, , 02/20/2020 16:59:16
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9.4.18 6.31pm(b) (5) [redacted], 194224 KB, Source O, , 02/20/2020 17:02:30
9.4.18 6.31pm(b) (5) [redacted] 195008 KB, Source P, , 02/21/2020 10:19:13
9.6.18 9.56am(b) (5) [redacted].pdf, 95712 KB, Source Q, , 02/21/2020 10:21:12
9.7.18 9.47am(b) (5) [redacted]g, 9536 KB, Source T, , 02/21/2020 10:28:36
9.7.18 6.40pm(b) (5) [redacted], 69632 KB, Source V, , 02/21/2020 10:36:09
9.7.18 9.45am(b) (5) [redacted] 9600 KB, Source R, , 02/21/2020 10:22:05
9.7.18 9.45am(b) (5) [redacted], 106784 KB, Source S, , 02/21/2020 10:23:59
9.7.18 9.47am(b) (5) [redacted] 71312 KB, Source U, , 02/21/2020 10:33:20
9.17.18 3.37pm(b) (5) [redacted], 9952 KB, Source W, , 02/21/2020 10:54:13
9.17.18 3.37pm(b) (5) [redacted] 65056 KB, Source AQ, , 02/21/2020 14:22:38
9.18.18 1.54pm(b) (5) [redacted], 15392 KB, Source Z, , 02/21/2020 11:04:34
9.18.18 1.54pm(b) (5) [redacted] 101632 KB, Source AA, , 02/21/2020 11:05:11
9.19.18 6.34pm(b) (5) [redacted], 10976 KB, Source X, , 02/21/2020 10:58:52
9.19.18 6.34pm(b) (5) [redacted] 211408 KB, Source Y, , 02/21/2020 11:00:05
9.24.18 10.38am(b) (5) [redacted] 144896 KB, Source AB, , 02/21/2020 11:13:02
9.25.18 4.07pm(b) (5) [redacted] 215920 KB, Source AD, , 02/21/2020 13:58:50
9.25.18 4.07pm(b) (5) [redacted] 215920 KB, Source AC, , 02/21/2020 13:32:38
9.25.18 8.51pm(b) (5) [redacted], 137488 KB, Source AE, , 02/21/2020 14:00:06
9.25.18 8.51pm(b) (5) [redacted], 43680 KB, Source AF, , 02/21/2020 14:00:31
9.26.18 1.32pm(b) (5) [redacted], 69520 KB, Source AG, , 02/21/2020 14:01:40
9.27.18 11.24am(b) (5) [redacted], 10464 KB, Source AI, , 02/21/2020 14:02:39
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10.29.18 11.49am(b) (5) [redacted], 173936 KB, Source AL, , 02/21/2020 14:20:08
10.31.18 10.28am(b) (5) [redacted]229760 KB, Source AM, , 02/21/2020 14:20:28
11.1.18 10.11am(b) (5) [redacted] 106256 KB, Source AN, , 02/21/2020 14:21:35
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(b) (5) [redacted] 2.20.18.docx, 5327392 KB, PSSC, , 02/27/2020 14:14:49

Approval:
Preliminary Approval, Renee McGhee-Lenart, 02/26/2020 13:06:33

History:
Gaida Mahgoub, 02/20/2020 09:18:09, Created
Gaida Mahgoub, 02/20/2020 11:05:57, Edited
Gaida Mahgoub, 02/20/2020 16:54:15,(b) (5) [redacted]
Gaida Mahgoub, 02/21/2020 10:58:28(b) (5) [redacted]f

Gaida Mahgoub, 02/21/2020 14:18:50, (b) (5) [redacted]

Renee McGhee-Lenart, 02/26/2020 13:06:33, Preliminary Approval
Renee McGhee-Lenart, 02/26/2020 13:07:12, Edited
Renee McGhee-Lenart, 02/26/2020 13:34:36, Edited

Workpaper - OA&E-FY19-0091 EPA Actions to Address Elevated Cancer Risks from Air Toxics Emissions from Point Sources

Created By: Bao Chuong 2/14/2020

Section: L.07
Subject: R1--Cathy Stepp Email Review
Program Name: Email Analyses

Information:

Status: In Progress **Review:**

In Progress Editors:

Current Editors: Roles: AIG_DAIG, Assigned Auditor, Audit In-Charge, Audit Manager, New employee, Product Line Director, Quality Assurance

Issues:

Comments:

Attachments:

- 6.21.18 554pm (b) (5) [redacted] 574320 KB, Source M, , 02/22/2020 00:47:04
- 6.21.18 1013am (b) (5) [redacted], 192688 KB, Source F, , 02/22/2020 00:02:05
- 6.21.18 1136am (b) (5) [redacted] 605808 KB, Source G, , 02/22/2020 00:03:00
- 6.21.18 1139am (b) (5) [redacted], 139712 KB, Source H, , 02/22/2020 00:14:08
- 6.21.18 1139am (b) (5) [redacted] 122032 KB, Source I, , 02/22/2020 00:17:12
- 6.21.18 1141am (b) (5) [redacted] 181568 KB, Source J, , 02/22/2020 00:24:12
- 6.21.18 1141am (b) (5) [redacted], 235824 KB, Source K, , 02/22/2020 00:33:54
- 6.21.18 1246pm (b) (5) [redacted] 3380864 KB, Source L, , 02/22/2020 00:38:25
- 6.22.18 428pm (b) (5) [redacted] 631728 KB, Source T, , 02/25/2020 12:44:32
- 6.22.18 851am (b) (5) [redacted] 190016 KB, Source N, , 02/22/2020 01:02:46
- 6.22.18 857am (b) (5) [redacted] 190016 KB, Source O, , 02/22/2020 01:09:05
- 6.22.18 858am (b) (5) [redacted] 126384 KB, Source Q, , 02/24/2020 14:14:19

6.22.18 913am(b) (5) [redacted],
245200 KB, Source R, , 02/24/2020 14:21:43
6.22.18 919am(b) (5) [redacted], 201680 KB, Source S, , 02/24/2020 14:29:04
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02/22/2020 01:11:06
7.2.18 653pm(b) (5) [redacted]
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7.17.18 10am(b) (5) [redacted] 202672 KB, Source V, , 02/25/2020 13:10:24
7.17.18 1234am(b) (5) [redacted] 113296 KB, Source W, , 02/25/2020 13:30:39
7.18.18 1136am(b) (5) [redacted] KB, Source X, , 02/25/2020
14:18:53
7.26.18 121pm(b) (5) [redacted] 1724672 KB, Source Y, , 02/25/2020 15:36:37
7.26.18 425pm(b) (5) [redacted] 186896 KB, Source Z, , 02/25/2020 15:37:08
7.26.18 942am(b) (5) [redacted], 1804096 KB, Source AA, , 02/25/2020 17:27:31
8.9.18 941am(b) (5) [redacted] 167184 KB, Source AB, , 02/25/2020 18:01:55
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8.20.18 921am(b) (5) [redacted] 177392 KB, Source AF, , 02/25/2020
23:08:29
8.20.18 1003am(b) (5) [redacted], 158224 KB, Source AE, , 02/25/2020
23:05:15
9.6.18 1232pm(b) (5) [redacted], 110944 KB,
Source AH, , 02/25/2020 23:25:49
9.7.18 1017am(b) (5) [redacted], 127696 KB, Source AI, ,
02/25/2020 23:34:57
9.7.18 1045am(b) (5) [redacted], 110064 KB, Source AG, , 02/25/2020 23:20:54
10.2.18 122pm(b) (5) [redacted], 185584 KB, Source
AK, , 02/26/2020 00:12:59
10.2.18 1224pm(b) (5) [redacted] 185424 KB,
Source AJ, , 02/25/2020 23:58:19
(b) (5) [redacted] 166448 KB, Source A, , 03/24/2020
10:17:02
Document1.docx, 8784 KB, Default Description, , 02/14/2020 13:20:25
Email review methodology.docx, 17744 KB, Source D, , 02/14/2020 14:57:59
FW_ OA&E-FY19-0091_ REQUEST FOR ACCESS TO E-MAIL RECORDS.pdf, 202352 KB,
Source C, , 02/14/2020 14:00:51
OA&E-FY19-0091_ REQUEST FOR ACCESS TO E-MAIL RECORDS (Approval Attached
Below).pdf, 344336 KB, Source B, , 02/14/2020 14:01:39
WP L.07 - (b) (5) [redacted], 61296 KB, Workpaper Narrative, , 03/26/2021 17:03:09

Approval:

Preliminary Approval, Renee McGhee-Lenart, 03/24/2020 10:17:10

History:

Bao Chuong, 02/14/2020 13:20:25, Created
Bao Chuong, 02/14/2020 14:57:47, (b) (5) [redacted]
Bao Chuong, 02/14/2020 15:17:59, Edited

Bao Chuong, 02/14/2020 17:33:18, (b) (5) [redacted]

Bao Chuong, 02/18/2020 16:53:11, (b) (5) [redacted]

Bao Chuong, 03/19/2020 11:01:47, Edited
Bao Chuong, 03/24/2020 00:05:52, Edited
Renee McGhee-Lenart, 03/24/2020 10:17:10, Preliminary Approval
Renee McGhee-Lenart, 03/24/2020 10:17:21, Edited
Renee McGhee-Lenart, 03/24/2020 10:17:28, Edited

Workpaper - OA&E-FY19-0091 EPA Actions to Address Elevated Cancer Risks from Air Toxics Emissions from Point Sources

Created By: Bao Chuong 2/14/2020

Section: L.08
Subject: R1 - Bill Wehrum Email Review
Program Name: Email Analyses

Information:

Status: In Progress **Review:**

In Progress Editors:

Current Editors: Roles: AIG_DAIG, Assigned Auditor, Audit In-Charge, Audit Manager, New employee, Product Line Director, Quality Assurance

Issues:

Comments:

Attachments:

- 1.9.19 652am (b) (5) [redacted], 115744 KB, Source AD, , 02/20/2020 16:22:29
- 2.20.19 340pm (b) (5) [redacted] 111152 KB, Source AE, , 02/20/2020 17:24:57
- 6.21.18 9am (b) (5) [redacted] 126752 KB, Source AI, , 03/19/2020 18:59:49
- 6.21.18 554pm (b) (5) [redacted] 574320 KB, Source G, , 02/14/2020 22:13:03
- 6.21.18 836am (b) (5) [redacted], 119168 KB, Source F, , 02/18/2020 17:05:39
- 6.22.18 505am (b) (5) [redacted] 176320 KB, Source H, , 02/18/2020 17:07:14
- 6.22.18 1003am (b) (5) [redacted] .pdf, 637056 KB, Source J, , 02/14/2020 23:51:07
- 6.22.18 1057am (b) (5) [redacted] 724624 KB, Source K, , 02/14/2020 23:50:44
- 6.22.18 1115am (b) (5) [redacted] 1059920 KB, Source L, , 02/14/2020 23:50:13
- 6.22.18 1238pm (b) (5) [redacted], 640512 KB, Source M, , 02/14/2020 23:49:55
- 6.22.18 (b) (5) [redacted], 26368 KB, Source I, , 02/14/2020 23:51:22
- 7.26.18 121pm (b) (5) [redacted] 1724672 KB, Source N, , 02/18/2020 21:31:38

7.26.18 425pm(b) (5) [redacted] 186896 KB, Source O, , 02/18/2020 21:38:40
8.13.18 751am(b) (5) [redacted], 283760 KB, Source AG, , 02/20/2020 22:12:41
8.14.18 1252pm(b) (5) [redacted], 228848 KB, Source AF, , 02/20/2020 18:52:49
8.19.18 914 AM(b) (5) [redacted]147120 KB, Source P, , 02/18/2020 21:50:34
8.21.18 346pm(b) (5) [redacted], 1483536 KB, Source Q, , 02/18/2020 21:59:40
8.21.18 349pm(b) (5) [redacted] 179472 KB, Source R, , 02/18/2020 22:08:37
8.22.18 325pm(b) (5) [redacted] 240672 KB, Source T, , 02/18/2020 22:47:03
8.22.18 1120am(b) (5) [redacted], 630976 KB, Source S, , 02/18/2020 22:31:41
9.11.18 435pm(b) (5) [redacted] 98368 KB, Source Y, , 02/19/2020 22:20:18
9.26.18 222pm(b) (5) [redacted] 133936 KB, Source AB, , 02/19/2020 23:03:28
9.26.18 244pm(b) (5) [redacted] 109136 KB, Source Z, , 02/19/2020 22:49:13
9.26.18 1018am(b) (5) [redacted], 174448 KB, Source U, , 02/19/2020 14:01:55
9.26.18 1150am(b) (5) [redacted] 99344 KB, Source X, , 02/19/2020 15:30:34
10.3.18 535am(b) (5) [redacted], 245120 KB, Source AH, , 02/20/2020 22:31:56
11.7.18 1130am(b) (5) [redacted] 318160 KB, Source AC, , 02/20/2020 13:38:36
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(b) (5) [redacted], 166448 KB, Source A, , 02/14/2020 17:12:30
(b) (5) [redacted], 8784 KB, Default Description, , 02/14/2020 15:29:51
(b) (5) [redacted], 151904 KB, Source W, , 02/19/2020 14:42:19
Email review methodology.docx, 17744 KB, Source D, , 02/14/2020 17:18:32
(b) (5) [redacted], 15648 KB, Source AA, , 02/19/2020 22:47:23
FW_ OA&E-FY19-0091_ REQUEST FOR ACCESS TO E-MAIL RECORDS.pdf, 202352 KB, Source C, , 02/14/2020 17:18:00
OA&E-FY19-0091_ REQUEST FOR ACCESS TO E-MAIL RECORDS (Approval Attached Below).pdf, 344336 KB, Source B, , 02/14/2020 17:13:22
(b) (5) [redacted], 76752 KB, Workpaper Narrative, , 02/03/2021 12:48:43

Approval:
Preliminary Approval, Renee McGhee-Lenart, 04/07/2020 10:17:23

History:
Bao Chuong, 02/14/2020 15:29:51, Created
Bao Chuong, 02/18/2020 17:05:55, (b) (5) [redacted]
Bao Chuong, 02/18/2020 17:07:24, (b) (5) [redacted]
Bao Chuong, 03/19/2020 11:02:02, Edited
Bao Chuong, 04/01/2020 22:11:39, Edited

Renee McGhee-Lenart, 04/07/2020 10:17:23, Preliminary Approval
Renee McGhee-Lenart, 04/07/2020 10:17:28, Edited
Renee McGhee-Lenart, 04/07/2020 10:17:34, Edited
Renee McGhee-Lenart, 04/07/2020 10:17:41, Edited

Workpaper - OA&E-FY19-0091 EPA Actions to Address Elevated Cancer Risks from Air Toxics Emissions from Point Sources

Created By: Bao Chuong 3/27/2020

Section: L.09
Subject: R1 - Mike Koerber Email Review
Program Name: Email Analyses

Information:

Status: In Progress **Review:**

In Progress Editors:

Current Editors: Roles: AIG_DAIG, Assigned Auditor, Audit In-Charge, Audit Manager, New employee, Product Line Director, Quality Assurance

Issues:

Comments:

Attachments:

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3.4.19 1036am (b) (5) [redacted], 103328 KB, Source AC, , 04/01/2020 18:39:38
5.6.19 515am (b) (5) [redacted], 187664 KB, Source AD, , 04/01/2020 18:40:36
5.14.19 626am (b) (5) [redacted] 174752 KB, Source AE, , 04/01/2020 18:41:06
5.21.19 109pm (b) (5) [redacted] 701776 KB, Source AI, , 04/01/2020 18:46:50
6.4.19 430am (b) (5) [redacted] 111888 KB, Source AF, , 04/01/2020 18:41:36
6.6.19 949am (b) (5) [redacted], 200704 KB, Source AJ, , 04/01/2020 18:47:29
6.21.18 9am (b) (5) [redacted], 126752 KB, Source F, , 04/01/2020 01:57:51
7.6.18 1035am (b) (5) [redacted]df, 160800 KB, Source G, , 04/01/2020 17:50:25
7.10.18 154pm (b) (5) [redacted], 360544 KB, Source H, , 04/01/2020 17:55:54

7.25.18 6am (b) (5) [redacted] 130656 KB, Source I, , 04/01/2020 17:58:03
7.26.18 504am (b) (5) [redacted], 94848 KB, Source J, , 04/01/2020 18:03:22
7.26.18 1053am (b) (5) [redacted], 1726464 KB, Source K, , 04/01/2020 18:12:46
7.26.18 1230pm (b) (5) [redacted] 110096 KB, Source L, , 04/01/2020 18:14:22
7.31.18 1219pm (b) (5) [redacted] 80608 KB, Source M, , 04/01/2020 18:14:57
8.1.18 231pm (b) (5) [redacted] 160096 KB, Source O, , 04/01/2020 18:20:09
8.1.18 1258pm (b) (5) [redacted], 7157600 KB, Source N, , 04/01/2020 18:18:20
8.2.18 118pm (b) (5) [redacted] 6220544 KB, Source P, , 04/01/2020 18:21:24
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8.2.18 458am (b) (5) [redacted] 179920 KB, Source R, , 04/01/2020 18:24:52
8.15.18 114pm (b) (5) [redacted], 107792 KB, Source S, , 04/01/2020 18:25:22
8.22.18 - 8.24.18 (b) (5) [redacted] 151392 KB, Source U, , 04/01/2020 18:30:50
8.22.18 1023am (b) (5) [redacted], 95360 KB, Source T, , 04/01/2020 18:26:15
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(b) (5) [redacted], 166448 KB, Source A, , 04/01/2020 01:35:46
Document1.docx, 8784 KB, Default Description, , 03/27/2020 12:54:37
Email review methodology.docx, 17744 KB, Source D, , 04/01/2020 01:38:36
FW_ OA&E-FY19-0091_ REQUEST FOR ACCESS TO E-MAIL RECORDS.pdf, 202352 KB, Source C, , 04/01/2020 01:37:41
OA&E-FY19-0091_ REQUEST FOR ACCESS TO E-MAIL RECORDS (Approval Attached Below).pdf, 344336 KB, Source B, , 04/01/2020 01:36:37
(b) (5) [redacted] 75744 KB, Workpaper Narrative, , 03/04/2021 15:53:05

Approval:

Preliminary Approval, Renee McGhee-Lenart, 04/07/2020 11:54:51

History:

Bao Chuong, 03/27/2020 12:54:36, Created
Bao Chuong, 03/27/2020 15:03:40, Edited
Bao Chuong, 03/30/2020 23:35:45, Edited

Bao Chuong, 04/01/2020 01:56:19, (b) (5) [redacted]
Bao Chuong, 04/02/2020 14:32:54, Edited
Renee McGhee-Lenart, 04/07/2020 11:54:51, Preliminary Approval
Renee McGhee-Lenart, 04/07/2020 11:55:01, Edited
Renee McGhee-Lenart, 04/07/2020 11:55:06, Edited

Workpaper - OA&E-FY19-0091 EPA Actions to Address Elevated Cancer Risks from Air Toxics Emissions from Point Sources

Created By: Andrew Lavenburg 2/28/2020

Section: L.10
Subject: R1--Kelly Rimer Email Review
Program Name: Email Analyses

Information:

Status: In Progress **Review:**

In Progress Editors:

Current Editors: Roles: AIG_DAIG, Assigned Auditor, Audit In-Charge, Audit Manager, New employee, Product Line Director, Quality Assurance

Issues:

Comments:

Attachments:

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6-21-18 (b) (5) [redacted], 211808 KB, Source G, , 02/28/2020 09:30:36
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Andrew Lavenburg, 02/28/2020 07:02:33, Created
Andrew Lavenburg, 03/04/2020 13:24:53, Edited
Andrew Lavenburg, 03/05/2020 15:47:38, (b) (5) [redacted]
Andrew Lavenburg, 03/11/2020 12:20:30, (b) (5) [redacted]
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Renee McGhee-Lenart, 03/17/2020 08:29:36, Edited
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Workpaper - OA&E-FY19-0091 EPA Actions to Address Elevated Cancer Risks from Air Toxics Emissions from Point Sources

Created By: Andrew Lavenburg 2/28/2020

Section: L.11
Subject: R1--Lew Weinstock Email Review
Program Name: Email Analyses

Information:

Status: In Progress **Review:**

In Progress Editors:

Current Editors: Roles: AIG_DAIG, Assigned Auditor, Audit In-Charge, Audit Manager, New employee, Product Line Director, Quality Assurance

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- 2-11-19 (b) (5) [redacted] 150288 KB, Source O, , 03/19/2020 10:28:02
- 8-15-18 (b) (5) [redacted], 176352 KB, Source B, , 03/25/2020 16:45:12
- 9-12-18 (b) (5) [redacted], 259840 KB, Source D, , 03/18/2020 13:35:06
- 9-12-18 (b) (5) [redacted], 149056 KB, Source C, , 03/18/2020 13:34:50
- 9-14-18 (b) (5) [redacted] 160432 KB, Source E, , 03/18/2020 13:35:27
- 9-18-18 (b) (5) [redacted], 2063232 KB, Source K, , 03/18/2020 14:46:08
- 9-18-18 (b) (5) [redacted] 2231696 KB, Source F, , 03/18/2020 13:35:57
- 10-17-18 (b) (5) [redacted], 2673776 KB, Source L, , 03/19/2020 08:01:41
- 10-18-18 (b) (5) [redacted], 150224 KB, Source G, , 03/18/2020 13:36:38
- 10-25-18 (b) (5) [redacted], 819408 KB, Source H, , 03/18/2020 13:37:24
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- (b) (5) [redacted]9120 KB, Source A, , 03/25/2020 16:45:06

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Andrew Lavenburg, 03/10/2020 15:37:07, (b) (5) [redacted]
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Workpaper - OA&E-FY19-0091 EPA Actions to Address Elevated Cancer Risks from Air Toxics Emissions from Point Sources

Created By: Bao Chuong 3/19/2020

Section: L.12
Subject: R1 - Clint Woods Email Review
Program Name: Email Analyses

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- 6.22.18 505am (b) (5) [redacted], 176320 KB, Source G, , 03/22/2020 20:59:04
- 6.22.18 917am (b) (5) [redacted] 157648 KB, Source H, , 03/22/2020 21:24:58
- 6.22.18 1003am (b) (5) [redacted] 637056 KB, Source I, , 03/22/2020 21:29:48
- 6.22.18 1057am (b) (5) [redacted] 724624 KB, Source J, , 03/22/2020 21:35:28
- 6.22.18 1115am (b) (5) [redacted] 1059920 KB, Source K, , 03/23/2020 15:20:36
- 6.22.18 1238pm (b) (5) [redacted], 640512 KB, Source L, , 03/23/2020 16:04:53
- 7.26.18 121pm (b) (5) [redacted], 1724672 KB, Source M, , 03/23/2020 18:25:09
- 7.26.18 504am (b) (5) [redacted], 125488 KB, Source Y, , 03/23/2020 21:50:56
- 8.13.18 751am (b) (5) [redacted] 283760 KB, Source N, , 03/23/2020 18:44:24
- 8.19.18 914 AM (b) (5) [redacted] 147120 KB, Source O, , 03/23/2020 18:48:23
- 8.20.18 418pm (b) (5) [redacted] 153168 KB, Source Z, , 03/25/2020 12:41:38

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WP L.12 - Clint Woods email review.docx, 73312 KB, Workpaper Narrative, , 03/04/2021 15:53:13

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Workpaper - OA&E-FY19-0091 EPA Actions to Address Elevated Cancer Risks from Air Toxics Emissions from Point Sources

Created By: Gaida Mahgoub 4/16/2020

Section: L.13
Subject: R1--Darcie Smith Email Review
Program Name: Email Analyses

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11.14.18 10.11am(b) (5) [redacted], 34816 KB, Source CJ, , 04/16/2020 22:04:56
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New cancer-causing danger in Baton Rouge-New Orleans corridor, EPA report says

By STEVE HARDY, DELLA HASSELLE and NICK REIMANN | Advocate staff writers **SEP 29, 2018 - 5:00 PM**

Yet again, researchers are finding that communities along the Mississippi River between Baton Rouge and New Orleans are at a greater risk for exposure to cancer-causing chemicals.

Three years ago, the U.S. Environmental Protection Agency declared that St. John the Baptist Parish had the highest cancer risk from airborne pollutants nationwide because of the "likely carcinogen" chloroprene.

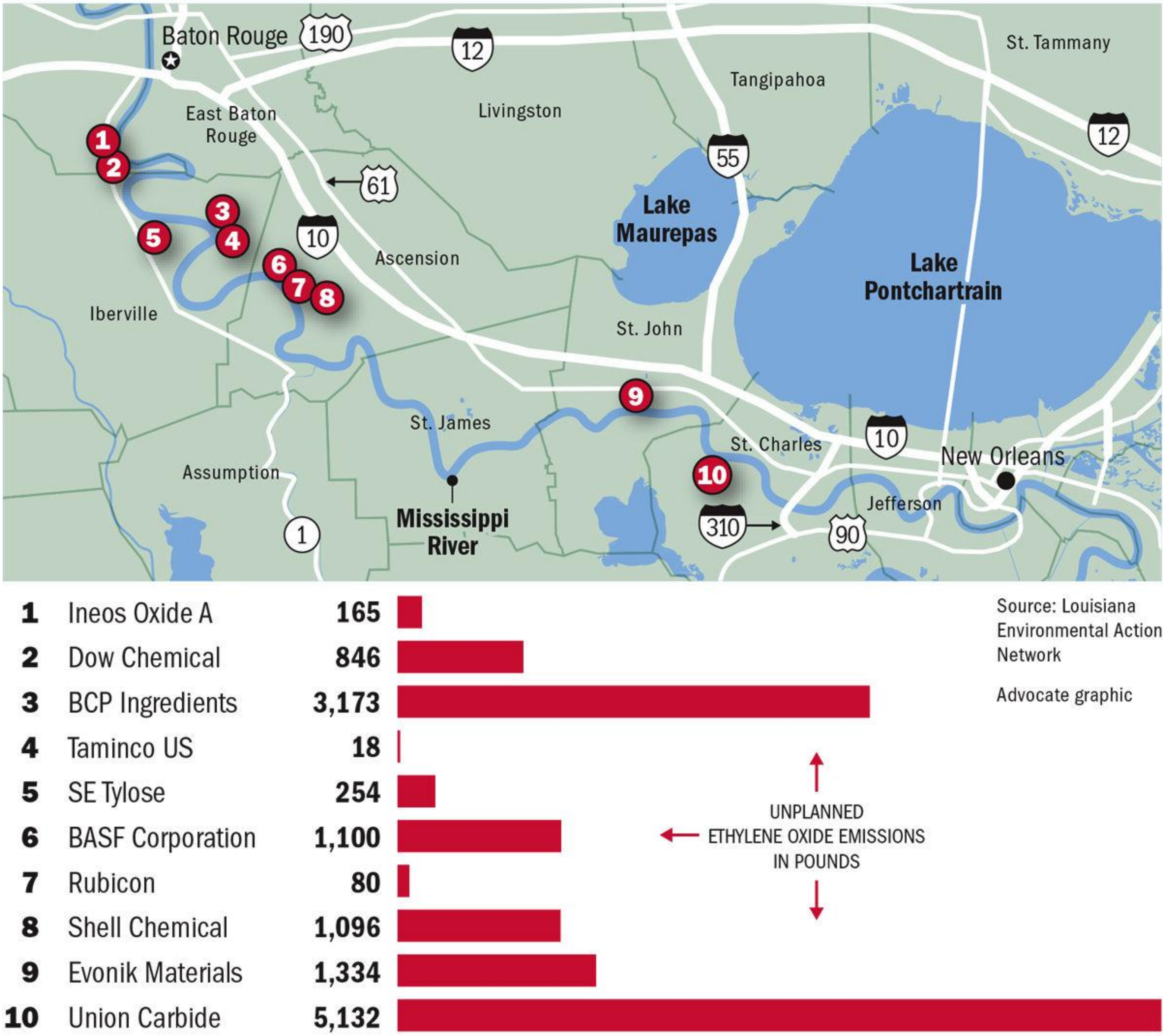
Now, the most recent National Air Toxics Assessment conducted by the EPA notes dangers from ethylene oxide. Some areas on the east side of the Mississippi River, around St. Gabriel and Geismar, are at more than twice the risk for certain cancers as their neighbors on the west side, where there are fewer petrochemical facilities. The numbers are even more staggering downstream.

Story Continued Below

Ethylene oxide — a chemical the EPA says is a proven carcinogen to humans — is produced throughout the United States but in disproportionately high amounts in St. Charles Parish, where scientists say residents in one census tract face the highest risk in the country of developing lymphoid or breast cancers from it.

CHEMICAL CORRIDOR

Ten facilities in the corridor between Baton Rouge and New Orleans reported emissions of "known carcinogen" ethylene oxide in 2016. Unplanned missions in pounds, by facility:



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The man made chemical, used in the production of antifreeze and polyester and to sterilize medical equipment, has been produced in Louisiana for decades. On the west bank of St. Charles, ethylene oxide has been made at the Union Carbide Corp. plant since it was built in the late 1960s.

Upriver, eight plants just south of Baton Rouge are noted on a list of ethylene oxide emissions in 2016.

Reginald Grace let out a long, low sigh when told of the newest EPA findings.

“That’s horrible. You’re fighting a giant,” said Grace, a leader of the Committee for a Better St. Gabriel.

Ethylene oxide is believed to contribute a 200 in a million chance of cancer development around St. Gabriel — twice the EPA’s acceptable upper limit. In less industrial areas, whether across the river or farther north, like in downtown Baton Rouge, the rate is closer to 70 in a million.

“I’m very concerned. We have a lot of people in our community who depend on the chemical industry for jobs and are afraid to speak up, but I’m not,” Grace said.

He recalled the persimmon trees, berry bushes and fishing spots around his home growing up, but now “all of that has subsided. … Everything is polluted. Chemicals have taken over.”

In Ascension Parish, the BASF facility in Geismar released 1,100 pounds of ethylene oxide in 2016, according to the EPA’s Toxic Release Inventory.

Travis Turner represents the area in the Ascension Parish Council. He had not yet seen the recent NATA report but said he would be willing to talk about additional regulations if a plant in his district was having an adverse effect on residents’ health.

“It’s definitely concerning if what they’re releasing is causing cancer,” Turner said.

BASF staff said their emissions number is misleading, and the site does not pose a risk to the public.

The Geismar plant has thousands of unwelded gas line connections at valves, flanges and screwed connections. Crews check those sites weekly to annually as required by regulation, but monitoring equipment is not sensitive enough to detect the smallest amount of escaped ethylene oxide, so the facility reports the minimum detectable amount, which adds up across the thousands of connections, said environmental health and safety director Dave Mihalik.

The campus had a release in early 2017 when a seal failed, and 40 to 50 pounds of ethylene oxide escape. But overall, Mihalik said, he feels safe working at the plant. Workers occasionally clip monitoring equipment to their uniforms to make sure they’re protected under regulations set forth by the Occupational Safety and Health Administration. The public at large also doesn’t need to worry, in part because BASF owns so much land around the Geismar site, staff said.

“If you did fence line (monitoring), you would not pick it up,” Mihalik said.

BASF uses ethylene oxide as an ingredient in a number of products, such as soap, shampoo and laundry detergent. It is consumed during manufacture and not present in the finished products, Mihalik said.

A spokeswoman with Dow Chemical Co., which owns Union Carbide, acknowledged that the company is one of the largest producers of ethylene oxide in the country but says it has "safely produced" it in St. Charles Parish since Dow took ownership of the plant in 2001.

"Dow is compliant with the current EPA regulations," said Ashley Mendoza, the company's public affairs manager. "We have always operated within our permitted emission standards."

While the plant has long met those industry standards, scientists' understanding of the dangers associated with the chemical has changed over time, according to the EPA. It was only in 2016 that the chemical was categorized as a carcinogen.

The change in classification brings greater demand for tighter regulation that could bring down acceptable emission levels. Agency scientists say they will now review the Clean Air Act and "evaluate opportunities" to reduce the emissions nationwide.

The EPA will also determine whether more immediate emission reduction strategies are necessary in local areas, scientists said in a release. Based on the data, those areas could include St. Charles and St. John.

To do so, however, the EPA will have to develop new monitoring techniques because current methods, including traditional air quality monitoring, aren't sensitive enough, according to the agency.

"Facility emissions testing, combined with air-quality modeling, can provide a more complete picture of ethylene oxide in the air ... than air-quality monitoring can currently provide," EPA scientists said.

In the meantime, residents in St. John worry that they're facing a double whammy of dangerous chemical exposures.

Union Carbide is just downriver from Denka Performance Elastomer in LaPlace. Denka is the only plant producing chloroprene in the country and the focus of the previous air toxins report released in 2015.

“I just feel like I want to vomit. I feel like I want to cry," said a tearful Cindy Russo, who lives in LaPlace. "I just feel so helpless. And you know, these two chemicals we’re talking about — that’s just two. There’s hundreds of other chemicals being manufactured out there.”

At a recent meeting of the activist group Concerned Citizens of St. John, Wilma Subra, an environmental scientist with the Louisiana Environmental Action Network, called ethylene oxide “much more toxic” than chloroprene.

Chloroprene is categorized as a "likely carcinogen," according to the EPA, whereas the classification for ethylene oxide was changed to "carcinogenic to humans" two years ago.

And while exposure to chloroprene can result in symptoms like breathing ailments, skin conditions and rapid heartbeat, Subra says limited evidence shows ethylene oxide could cause spontaneous abortions, damage to developing fetuses and harm to the brain and nervous system.

As she presented a 23-page report on the chemical, many audience members gasped. Some even wiped away tears.

“I’m scared to breathe,” said Tish Taylor, a member of the group.

Mustard gas and other uses

Ethylene oxide, which appears in gas and liquid form, has been around since 1859, when it was first prepared by a French chemist named Charles-Adolphe Wurst.

During World War I, it was used as a precursor to make the chemical weapon mustard gas. Production was altered in 1931 by French chemist Theodore Lefort, who figured out how to make it directly from ethylene by using silver as a catalyst.

The chemical is now used primarily as an intermediate, meaning it is used to make other chemicals, and as a sterilizing agent for medical equipment. It’s also used as a fumigating agent for spices.

As a gas, the chemical has the odor of ether — a slightly sweet smell, according to scientists.

The EPA officially deemed the chemical to be a carcinogen in a report issued December 2016, but had said in draft reviews as early as 2014 that the chemical could cause cancer to those exposed by breathing it in over a long term.

Scientists with the agency found the chemical to be carcinogenic to laboratory animals, inducing tumors in the lymphatic system, brain, lung, uterus and mammary gland, according to a 2014 assessment.

The agency also said there was evidence that it was dangerous to humans, and caused lymphoid and breast cancers to exposed workers.

Based on the studies and evidence, the EPA determined that over a lifetime measured as 70 years — a person could contract those cancers if they were exposed to 0.003 micrograms per cubic meter constantly, every day.

By comparison, chloroprene is considered risky at a constant exposure of 0.2 micrograms per cubic meter, the EPA has said.

At risk in the River Parishes

As of 2016, there were 118 industrial facilities releasing ethylene oxide in the U.S., according to the NATA report, which was released this year but uses emissions data from 2014.

Thirteen of those facilities are located in Louisiana.

In one census tract in St. Charles Parish just across the river from the Union Carbide plant constant exposure to the emissions would result in an estimated 710 people out of a million contracting cancer. That's a jaw-dropping figure, considering the upper limits of what national regulators deem acceptable is 100 people in a million. The national average is just 1.3 people in a million.

In 2016, Union Carbide deliberately released an estimated 30,700 pounds of ethylene oxide, and an estimated 5,100 unplanned pounds of the produced gas also escaped into the air, according to an EPA database. The only U.S. industrial facility releasing more ethylene oxide into the air is located in Port Neches, Texas, according to a separate EPA database.

In St. John, a chemical company called the Evonik Materials Corp. also added to the area's emissions of the carcinogen. Data collected from the EPA shows it released about 1,300 pounds into the air in 2016. Closer to Baton Rouge, BCP Ingredients near St. Gabriel released 3,173 pounds.

The fact that the EPA hasn't yet begun monitoring the air quality or the chemical emissions coming from the plants came as a surprise for some River Parishes residents who have been closely tracking the EPA's air quality data on chloroprene for more than a year now.

But Subra said that ethylene oxide isn't one of the chemicals the EPA is testing for right now, in part because the chemical was so recently categorized as a carcinogen, and in part because the equipment in place now isn't sensitive enough to measure for it.

“You can’t just do a canister test for it,” Subra said, underscoring that because such tiny amounts are thought to cause health risks, it has to be measured in thousandths of a microgram per cubic meter.

The EPA has estimated cancer risk, however, based on how much of the chemical the plants put out each year. The science isn’t perfect, as estimates based on production are different from measuring how much of the chemical actually escapes from the facility into the air, and also how much of it sticks around in communities after wind and other environmental factors come into play.

Local government officials said little when shown the results, with a spokeswoman for the St. Charles Parish administration, Adrienne Bourgeois, saying that “it would be inappropriate to comment on this matter at this time." Baileigh Rebowe, a spokeswoman for the St. John administration, did not return a call seeking comment.

Gregory Langley, a spokesman with the Louisiana Department of Environmental Quality, said that the department is aware of the NATA report and plans to meet with facilities producing ethylene oxide to discuss "possible emissions reductions options," but that there is "no timetable for reductions or monitoring at present."

He also underscored that the LSU Tumor Registry shows no increased incidence of cancers associated with ethylene oxide in St. Charles or St. John parishes.

Moreover, Langley said that industry would be challenging the science behind the NATA report. The industry's trade association, the American Chemical Council, will be filing a "request for correction," he said, asking the EPA to withdraw the data behind the study.

Chuck Brown, the DEQ secretary, has challenged previous EPA recommendations.

When the latest NATA study showed St. John had the highest risk of cancer from airborne pollutants due to chloroprene, Brown told Parish Council members and residents that there was "no smoking gun," and that the health-based exposure limit the EPA suggested for emissions was not "enforceable."

REPORT OF
AIR POLLUTION SOURCE TESTING
OF AN ETHYLENE OXIDE EMISSION-CONTROL SYSTEM
OPERATED BY STERIGENICS, US, LLC
IN WILLOWBROOK, ILLINOIS
ON SEPTEMBER 20, 2018

WILLOWBROOK II FACILITY

Submitted to:

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY
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Revision 1

OCTOBER 30, 2018

ECSi

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ECSi

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LIST OF APPENDICES

1.0 INTRODUCTION

Revision 1 was completed at the request of USEPA and IEPA. Revisions made to the report include:

- Conversion made from wet ppm to dry ppm formula added to Section 5.9.
- Section 8.0 Test Results show efficiency changed from ≥99.5133 to ≥99.5056%.
- Tables 1 and 2: Added columns to show dry ppm conversion values for inlet and outlet concentrations
- Tables 1 and 2: Included moisture/temperature calculation averages for each run.
- Tables 1 and 2: Mass Flow values were previously calculated in lbs./second and labeled lbs./minute. Edit made to show values in lbs./minute.

On Thursday, September 20, 2018, ECSi, Inc. performed air pollution source testing of an ethylene oxide (EtO) emission-control device operated by Sterigenics US, LLC at their Willowbrook II ethylene oxide sterilization facility located at 830 Midway Drive. The control device tested was a two-stage Advanced Air Technologies (AAT) Safe Cell emission-control system, comprised of a packed-tower chemical scrubber and a dry-bed reactor, used to control emissions from four sterilizer vacuum pumps, four sterilizer backvents, and two aeration rooms.

The purpose of the testing program was to demonstrate compliance with the conditions established in Section 6 of the Construction Permit (Application No: 18060020) granted to Sterigenics by the Illinois Environmental Protection Agency (IEPA) to control emissions from the sterilization chamber backvents. See Appendix L.

Test Protocols were submitted and approved by IEPA prior to testing. Copies of protocols and approval are included with Appendix L.

Representatives from Sterigenics were present during the testing as well as personnel listed below:

- Kevin Mattison, IEPA
- Ned Shappley, US EPA, OAQPS
- Margaret Sieffert, US EPA, Region 5
- Paul Farber, PE (Consultant for Village of Willowbrook)
- Lawrence Link, Tri-State Fire Department

2.0 EQUIPMENT

The gas sterilization and emission control equipment in Willowbrook II consists of the following:

- Four Sterilizers, each comprised of a steam-heated sterilization chamber, a vacuum pump chamber evacuation system, and a backvent valve;
- Two aeration rooms, each comprised of a heated aeration space.

Chamber exhaust, backvents, and aeration emissions are controlled by:

- One two-stage Advanced Air Technologies (AAT) Safe Cell emission-control system, comprised of a packed-tower acid/water scrubber (SC1), equipped with a packed reaction/interface column, a scrubber fluid recirculation system, and a scrubber fluid reaction/storage tank, and a dry bed reactor/scrubber (SC2), comprised of a bank of solid-bed reaction vessels containing Safe-Cell IIA Reactant for EtO control, connected in parallel, installed downstream of SC1 and upstream of a dedicated blower exhaust system designed to operate at 10,150 cfm.

3.0 RULE/COMPLIANCE REQUIREMENTS

The EtO gas-sterilization system at the Willowbrook II facility was tested to demonstrate compliance with requirements specified in the Construction Permit issued by IEPA (Application No: 18060020) and CAAPP Permit No: 043110AAC. The following requirements must be met:

- The existing emission control equipment for chamber exhaust and aeration room emissions is required by 40 CFR Part 63, Subpart O to achieve a control efficiency of 99% or greater.
- Chamber backvent emissions are not regulated through the federal regulations at 40 CFR Part 63, Subpart O. By way of permit application 18060020, Sterigenics has voluntarily elected to control backvent emissions using existing emission control equipment at the facility already required to achieve 99% or greater control efficiency.

Testing is required to demonstrate continued compliance with these requirements.

4.0 TESTING

EtO source testing was conducted in accordance with the procedures outlined inUS EPA Reference Methods 2, 3, 4 and 18. EtO emissions monitoring was conducted simultaneously at the inlet and outlet of the AAT System during the 15-minute duration of the backvent process. Three 15-minute test runs were performed.

4.1 TEST SCENARIO

Once a sterilization chamber cycle ends, a sample from inside the chamber is taken and measured to ensure the EtO concentrations are below 25% of the lower explosive limit (LEL) for safety reasons. Current controls interlocks will not allow the doors to be open if the concentration of EtO at the end of a cycle exceeds 25% LEL. Once this criterion has been met, the process requires the chamber door to be partially opened for 15 minutes which vents the EtO in the chamber to reduce levels in the chamber and exposure to employees. The 15-minute duration ensures the highest concentration of EtO is removed from the chamber prior to unloading the product. During this venting, EtO exhausts through the backvent and to the AAT scrubber. In accordance with the facility's procedures, workers are not allowed to enter or unload the chamber until the 15-minute time period has passed. Once the 15-minutes has passed, the product is unloaded to the aeration room.

To meet Condition 6 of the Construction Permit which requires conditions for testing to be conducted as representative of maximum emissions, each test run was completed on the backvents using freshly sterilized product from one chamber for a 15-minute duration, for a total of three test runs at each facility. The emission testing of the sterilization chambers occurred while running FDA validated cycles with higher ending EtO concentrations for testing. Each test interval tested the first 15 minutes the backvent is opened and exhausted to the AAT scrubber.

4.2 PROCESS PARAMETERS MONITORED

Based on the overall AAT scrubber liquor storage volume, relatively short duration of the test, and knowledge of the operation of the AAT system, the properties of the AAT scrubber liquor were not expected to change significantly during the test. Because of this, the AAT Scrubber tank level, pH, and glycol concentration (measured via refractometer) were monitored and recorded before and after the performance of the three trial runs. Results are presented in Appendix A.

Cycle information for each test run, including ending EtO concentration in the chamber space, also was recorded. Emission levels from aeration also were recorded before performance of the three trial runs. Results are presented in Appendix A.

During routine operations, weekly concentration sampling of the AAT system is conducted using samples collected from the AAT system outlet using a Tedlar bag and the facility's gas chromatograph system. Since this performance testing involved real-time analysis of the inlet and outlet concentrations of the AAT system, Tedlar bag sampling was not conducted during these tests.

4.3 TESTING EQUIPMENT

Testing equipment information and certifications are located in Appendix G.

5.0 TEST METHOD REFERENCE

5.1 INTRODUCTION

EtO source testing was performed in accordance with US EPA Reference Methods 1, 2, 3, 4 and 18. EtO emissions monitoring was conducted simultaneously at the inlet and outlet of the AAT System during each 15-minute duration of the backvent process. A total of three test runs was performed.

During backvent testing, EtO emissions at the inlet and the outlet of the AAT Safe Cell System were determined using direct source sample injection into the gas chromatograph (GC). The GC used to analyze EtO concentrations was a SRI Model 8610 (also described in Section 5.3).

US EPA Method 1: Sample and Velocity Traverses for Stationary Sources (40 CFR 60 Appendix A)

Sample ports and flow traverse locations were located at the inlet and outlet of the AAT control device. Numbers of flow traverse locations were selected to exceed those recommended by Tables 1.1 and 1.2, and were spaced throughout the duct in accordance with Method 1. The average angle of cyclonic flow at each traverse point was less than the maximum average angle specified in Method 1. For further information on sample port locations, sample and velocity traverses, and cyclonic flow measurements please see Appendix B.

US EPA Method 2: Determination of Stack Gas Velocity and Volumetric Flow Rate (Type S Pitot Tube) (40 CFR 60 Appendix A).

The average gas velocity in a stack is determined from the gas density and from measurement of the average velocity head with a Type S (Stausscheibe or reverse type) Pitot tube. This method was used in its entirety as per the procedures outlined in Method 2.

ESCI performed a cyclonic flow check and velocity traverse using an S-type Pitot tube in each duct prior to the first test run. These results were used to calculate EtO mass flow rates. ESCI also used a standard Pitot tube constructed in accordance with Method 2C to measure velocity at a single point in the duct during the test runs to verify that gas flow rate remained steady during tests.

US EPA Method 3: Gas Analysis for the Determination of Dry Molecular Weight (40 CFR 60 Appendix A)

The Construction permit at 6(b) specifies testing using Method 3A or 3B (for calculating the dry molecular weight of the duct gases based on measurement of the duct gas oxygen and carbon dioxide concentrations). In accordance with Method 2, Section 8.6 and the approved Test Protocol, a dry molecular weight of 29.0 was assumed instead of by calculation. This is in accordance with Method 2 and is allowed by Method 3 because the process does not involve combustion and emits essentially ambient air.

US EPA Method 4: Determination of Moisture Content in Stack Gases (40 CFR 60 Appendix A)

The moisture concentrations in the duct gases were calculated assuming saturated conditions based on the measured gas temperature, duct static pressure and barometric pressure, in accordance with Method 4(16.4). For calculations pertaining to this method, see Appendix D.

- Barometric pressure was determined using local meteorological data from the time and date of the actual testing. See Appendix F.

- Duct static pressure was determined using an inclined oil manometer.

- Duct gas temperature was determined using from a type K thermocouple and thermometer.

US EPA Method 18: Measurement of Gaseous Organic Compound Emissions by Gas Chromatography

The major organic component of the gas mixture, EtO is separated by gas chromatography (GC). Measurement of EtO concentrations across the inlet/outlet ducts are expected to be uniform due to extensive air mixing throughout the emission control system. During backvent operations, constituents of the streams entering and exiting the AAT System were analyzed at a single point by an SRI, Model 8610, portable GC, equipped with the following: dual, heated sample loops and injectors; dual columns; and dual detectors. A flame ionization detector (FID) was used to quantify inlet EtO emissions, and photoionization detector (PID) was used to quantify low-level EtO emissions at the emission control system outlet. The PID was equipped with a 11.7eV lamp. For chromatographic data associated with the use of this method, see Appendix E. The sample transport system is described in Section 5.4 of this report.

Samples were continuously extracted and analyzed at approximately one- to two-minute intervals, for a total of 12 to 13 samples, during each 15-minute test run.

5.2 VOLUMETRIC FLOW MEASUREMENT

Exhaust gas flow at the inlet and outlet of the AAT scrubber was determined by Method 2, using an S-type pitot tube and an inclined-oil manometer. Sampling ports were located in accordance with Method 1. The test ports were located far enough from any flow disturbances and velocity was measured at multiple points within the duct cross-section to permit accurate flow measurement. Equal-area traverse points for pre-test velocity traverses were selected in accordance with Method 1. Confirmation of the absence of cyclonic flow occurred prior to the commencement of the three test runs. Please see Appendices B and F for additional Method 1 related information.

Because of the short duration of the backvent operation, traversing the entire stack during each minute of test run was infeasible. With approval of IEPA and US EPA, an average differential pressure point was determined before the test, and that parameter was used to confirm flow during each minute while concentration samples were collected. Please see Appendix F for tables of this information collected in the field.

Temperature measurements were obtained from a type K thermocouple (FLIR EA10) and thermometer attached to the sampling probe. Exhaust gas composition was assumed to be air saturated with water vapor.

5.3 CONTROL EFFICIENCY AND MASS EMISSIONS MEASUREMENT

During backvent operations, constituents of the streams entering and exiting the AAT System were analyzed by an SRI, Model 8610, portable gas chromatograph (GC), equipped with the following: dual, heated sample loops and injectors; dual columns; and dual detectors. A flame ionization detector (FID) was used to quantify inlet EtO emissions, and photoionization detector (PID) was used to quantify low-level EtO emissions at the emission control system outlet. The PID was equipped with an 11.7eV lamp. The mass of EtO in the inlet and outlet streams were determined using equation shown below in Section 5.9. EtO mass control efficiency during the backvent process was calculated by comparing the mass of EtO vented to the system inlet to the mass of EtO vented from the system outlet. See equation shown in Section 5.9.

5.4 SAMPLE TRANSPORT

The Willowbrook II facility utilizes a dual stage AAT system equipped with a 10,150 cfm rated blower system that serves to quickly draw process emissions from the sources through the control system. The AAT Scrubber system efficiency operates at a very high level in large part due to the use of sulfuric acid in the scrubber liquor, which lowers the pH of the solution and acts as a catalyst - increasing the speed of the hydrolysis of ethylene oxide to ethylene glycol.

The gas sample was continuously pumped to the GC at approximately 1000 cubic centimeters per minute (cc/min) from the sample probe through two 100-foot lengths of heated and insulated 3/8" Teflon® sample line (.030 wall), each with an interior volume of approximately 1535 cubic centimeters. The source gas was pumped to the GC with a response time of approximately 1.5 seconds. See Appendix H for sample line volume and residence time calculations.

The lines were heated to ≥ 110 °C. Temperature of the heated lines was monitored before, during and after each trial run via observing the temperature on the heated lines temperature controller. See Appendix A for this data. The sample probe was constructed of stainless steel tubing and was not heated.

At the inlet of the Safe Cell System, the sampling ports were located in the duct immediately upstream of the packed tower scrubber. At the outlet of the AAT System, sampling ports were located in the exhaust stack downstream of the dry bed reactors. See Appendix B for sampling port location information.

5.5 GC INJECTION

Source-gas samples were then injected into the GC which was equipped with two heated sampling loops, each containing a volume of approximately 2 cubic centimeters (cc) and maintained at 100 degrees Celsius (°C). Injections occurred at approximately one to two-minute intervals during backvent testing. Helium was the carrier gas for both the FID and the PID.

5.6 GC CONDITIONS

The packed columns for the GC were both operated at 90 °C. The columns were stainless steel, 6 feet long, 0.125 inch outer diameter, packed with 1 percent SP-1000 on 60/80 mesh Carbopack B.

During the analysis, the FID was operated at 250 °C. The support gases for the FID were hydrogen (99.995% pure) and air (99.9999% pure). Any unused sample gas was vented from the GC system back to the inlet of the control device being tested.

5.7 CALIBRATION STANDARDS

The FID was calibrated for mid-range part-per-million-by-volume (ppmv) level analysis using gas proportions similar to the following:

1) 1000 ppmv EtO, balance nitrogen ***
2) 100 ppmv EtO, balance nitrogen
3) 50 ppmv EtO, balance nitrogen (audit gas)
4) 10 ppmv EtO, balance nitrogen
5) 1 ppmv EtO, balance nitrogen

***Note: Calibrations for this standard were performed following the test to confirm appropriate range of instrument.

The PID was calibrated for low-range ppmv level analyses using gas proportions similar to the following:

1) 100 ppmv EtO, balance nitrogen
2) 50 ppmv EtO, balance nitrogen (audit gas)
3) 10 ppmv EtO, balance nitrogen
4) 1 ppmv EtO, balance nitrogen

See Appendix J for calibration gas certifications. Please see Appendix I for triplicate calibration data performed before and after each set of test runs and calibration curves.

As a part of the test's quality assurance, limit of detection and recovery studies were performed. Refer to that section later in the document and Appendices K and I, respectively for further information.

5.8 SAMPLING DURATION

Testing was performed in 15-minute increments in conjunction with normal production operations, for each of the three test runs while chamber backvents were operating.

5.9 SAMPLE CALCULATIONS

Method 1

Equivalent diameter was calculated as follows:

$$D_e = \frac{2(L)(W)}{L+W}$$

Actual diameters of round ducts and equivalent diameters of square and rectangular ducts were used to evaluate whether sufficient distance existed between the sample ports and upstream and downstream flow disturbances. These figures were used in conjunction with Method 1's Table 1.1 and 1.2 to ensure that the minimum number of traverse points required for testing was exceeded.

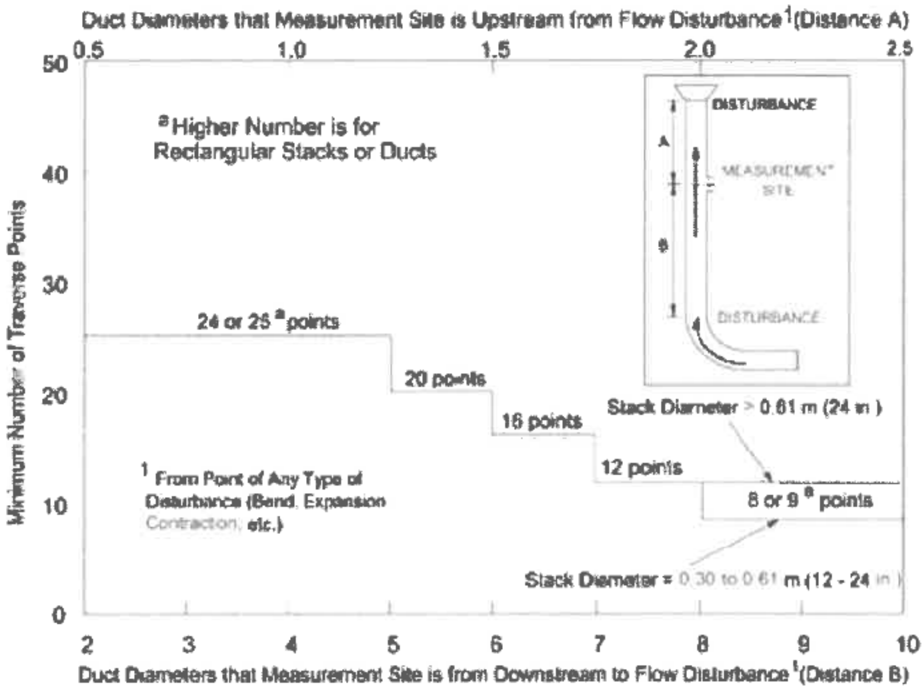


Figure 1-1. Minimum number of traverse points for particulate traverses

* * * * *

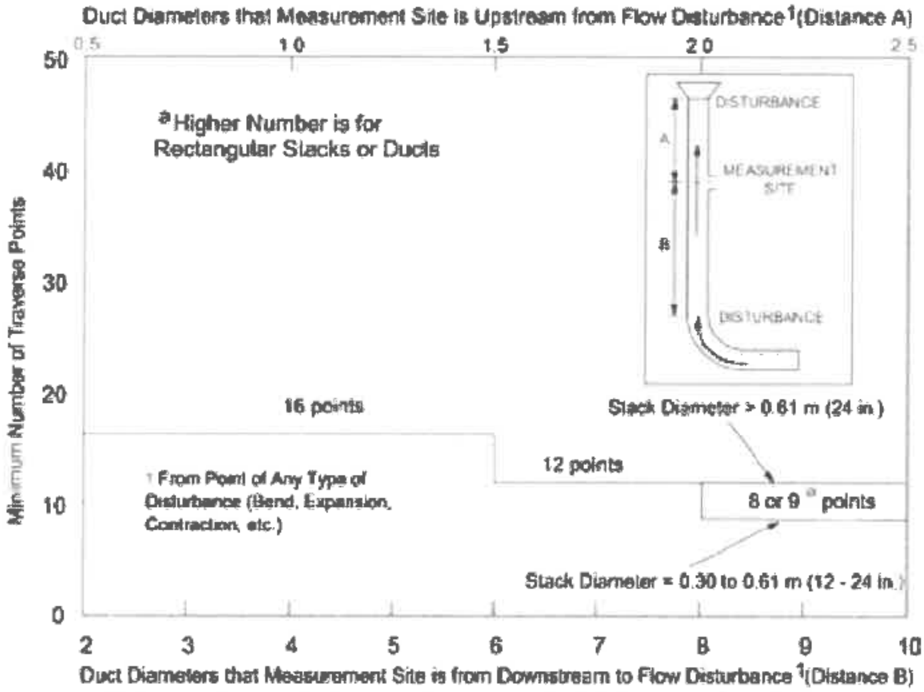


Figure 1-2. Minimum number of traverse points for velocity (nonparticulate) traverses

Method 2

Stack gas velocity and volumetric flow rate were calculated using equation 2-7 and 2-8 as outlined in Method 2.

Q = Average Stack Gas Dry Volumetric Flow Rate (dscf/min)

$$= 60\,(1 - B_{ws})\,V_s\,A \left| \frac{T_{std}\,P_s}{T_{s(abavg)}P_{std}} \right|$$

V_s = Average Stack Gas Velocity

$$V_s = K_p\,C_p \left[\frac{\sum_{i=1}^{n} \sqrt{\Delta p_i}}{n} \right] \sqrt{\frac{T_{s\,(abavg)}}{P_s\;M_s}}$$

Where:

K_p = Velocity equation constant

$$= \quad 85.49 \frac{ft}{\sec} \left[\frac{(lb/lb - mole)(in.\,Hg)}{(^{o}R)(in.\,H_2O)} \right]^{1/2}$$

C_p = Pitot Tube Coefficient = 0.84 (S-type pitot tube coefficient for geometric calibration)

Δp_i = Individual velocity head reading at traverse point "i" (in. Hg)

n = number of traverse points

$T_{s(abavg)}$ = Average absolute stack temperature (°R)

P_s = Absolute stack pressure (P_{bar} + P_g)

P_{bar} = Barometric pressure at measurement site (in. Hg)

P_g = Stack static pressure (in. Hg)

M_s = Molecular weight of stack gas, wet basis

$$\mathrm{M_s = M_d\;(1 - B_{ws}) + 18.0B_{ws}}$$

Method 4

Moisture content was determined using the calculation for saturation in accordance with Method 4.

$$B_{ws(svp)}(\%) = 100\left(\frac{10^{\left(6.691-\left(\frac{3144}{T_{s\,(avg)}+390.86}\right)\right)}}{\left(P_b + \frac{P_{static}}{13.6}\right)}\right)$$

Where:

$B_{ws(svp)}(\%)$ = Saturated moisture concentration (% by volume)

$T_{s(abavg)}$ = Average absolute stack temperature (°F)

P_b = Barometric pressure at measurement site (in. Hg)

P_{static} = Stack static pressure (in. H_20)

Mass Emission Calculation

Mass emissions of EtO during backvent were calculated using the following equation:

W = (Q)(MolWt)(C /10^6)/(MolVol)

Where:

W	=	EtO mass flow rate, pounds per minute
Q	=	Corrected duct gas volumetric flow rate, dry standard cubic feet per minute at 68 degrees F and 29.92 in. Hg (see calculation under Method 2)
MolWt	=	44.05 pounds EtO per pound mole
C	=	EtO concentration, parts per million by volume
10^6	=	Conversion factor, ppmv per "cubic foot per cubic foot"
MolVol	=	385.32 cubic feet per pound mole at 68 degrees F and 29.92 in. Hg

Control Efficiency Calculation

Mass control efficiency of EtO during backvent was calculated using the following equation:

Efficiency = $(W_i - W_o / W_i)(100)$

Where:

W_i = Mass flow rate to the control device inlet, pounds per minute, calculated as described above where:

C_i = EtO concentration at the control device inlet, ppm

Q_i = Duct gas volumetric flow rate at the control device inlet, dry standard cubic feet per minute

W_o = Mass flow rate from the control device outlet, pounds per minute calculated as described above where:

C_o = EtO concentration at the control device outlet, ppm

Q_o = Duct gas volumetric flow rate at the control device outlet, dry standard cubic feet per minute

Correction to Dry Basis

Dry basis concentration = (wet basis concentration) / (1-w)

where:

w = fraction of emitted exhaust gas, by volume, which is water vapor.

Results of the control-efficiency testing are presented in Section 8.0 and in Table 1 and 2.

6.0 TEST SCENARIO

Backvent testing was performed during normal process load conditions, with freshly sterilized product in the sterilization chambers. Three test runs were conducted in series to verify the performance of the emission-control system.

Sterigenics scheduled three chambers to end the sterilization cycle to allow for the three test runs to run consecutively. The general testing sequence was as follows:

Timing	Task	Method
Prior to test	Sample locations established	Method 1
Prior to test	Sample traverse locations established	Method 1
One time prior to each set of runs	3-point calibration performed in triplicate.	Method 18
One time prior to each set of runs	Confirm absence of cyclonic flow	Method 1
One time prior to each set of runs	Collect AAT system scrubber liquor pH, tank level, and glycol % information. Note levels present from aeration.	N/A
One time prior to each set of runs	Flow traverse of inlet and outlet conducted to establish flow rate and measurement centroid	Method 2
Prior to each test run	Note temperature reading of heated lines	N/A
Over test duration	Chamber door opened approximately 12 inches, actuator switch activates backvent	N/A
Beginning of each run	First sample initiated	Method 18
Over test duration	Samples at inlet and outlet taken approximately every 1-minute for a total of 15-minutes	Method 18
Over test duration	Flow monitoring sampled approximately every 1-minute.	Method 2
Mid-Test	Note temperature reading of heated lines	Method 18
After each test run	Collect cycle number and ending backvent EtO concentration in chamber head space are noted	N/A
After each test run	Note temperature reading of heated lines	Method 18
After each test run	Conduct recovery study	Method 18
After conclusion of each set of test runs	Perform post calibration checks	Method 18
After conclusion of each set of test runs	Collect AAT system scrubber liquor pH, tank level, and glycol %.	N/A
One time following each set of runs	Obtain meteorological data for sampling time	N/A
At least once during two test days for WB I and WB II	Perform Limit of Detection Study	Method 18

7.0 QA/QC

7.1 FIELD TESTING QUALITY ASSURANCE

At the beginning of the test, the sampling system was leak checked at a vacuum of 15 inches of mercury. The sampling system was considered leak free when the flow indicated by the rotameters fell to zero.

At the beginning of the test, a system blank was analyzed to ensure that the sampling system was free of EtO. Ambient air was introduced at the end of the heated sampling line and drawn through the sampling system line to the GC for analysis. The resulting chromatogram also provided a background level for non-EtO components (i.e. ambient air, carbon dioxide, water vapor) which are present in the source gas stream due to the ambient dilution air which is drawn into the emission-control device, and due to the destruction of EtO by the emission-control device which produces carbon dioxide and water vapor. This chromatogram, designated ambient background, is included with the calibration data in Appendix I.

A recovery study was also performed in accordance with Section 8.4.1 of Method 18 using 10 ppm and 100 ppm EtO calibration gas. The 100 ppm calibration gas was drawn through the heated sample line used at the control device inlet, and the 10 ppm calibration gas was drawn through the heated sample line used at the control device outlet. The calibration procedure was repeated in this manner, and it was verified that the analyzer response was within 10% of the calibration gas concentration sampled. See calibration data in Appendix I for further information regarding the recovery study.

7.2 CALIBRATION PROCEDURES

The GC system was calibrated at the beginning and conclusion of each day's testing. Using the Peaksimple II analytical software, a calibration curve was constructed for each detector. Calibration data can be found in Appendix I.

A seven-point Method Detection Limit (MDL) or Limit of Detection (LOD) study was performed prior to testing using procedures described in Section 15.0 of US EPA Method 301 (40 CFR 63 Appendix A) and in 40 CFR 136 Appendix B. The study was recommended by OAQPS and accepted by IEPA. The LOD for this test was determined to be 0.10ppm. A recovery study was also performed in accordance with Section 8.4.1 of Method 18 using 10 ppm and 100 ppm EtO calibration gas. The 100 ppm calibration gas was drawn through the heated sample line used at the control device inlet, and the 10 ppm calibration gas was drawn through the heated sample line used at the control device outlet. The calibration procedure was repeated in this manner, and it was verified that the analyzer response was within 10% of the calibration gas concentration sampled. Results of the LOD study are presented in Appendix K. Results of the recovery study are presented in Appendix I.

All calibration gases and support gases used were of the highest purity and quality available. A copy of the laboratory certification for each calibration gas is attached as Appendix J.

8.0 TEST RESULTS

The AAT Safe Cell System demonstrated an EtO control efficiency of greater than 99.51 percent. In accordance with various state and federal requirements, this control equipment must have an EtO control efficiency of 99 percent or more. The AAT Safe Cell System has met this requirement.

The test results are summarized in Tables 1 and 2. These tables include results for EtO control efficiency of the emission-control device. Sample calculations related to destruction efficiency and other calculations can be found in Section 5.9.

TABLES 1 AND 2

TABLE 1
ETHYLENE OXIDE CONTROL EFFICIENCY SUMMARY – BACKVENT
STERIGENICS - WILLOWBROOK, ILLINOIS (PLANT 2)
SEPTEMBER 20, 2018

Test Run	Inlet Average Concentration (ppm)	Inlet Average Mass Flow rate (lb/min)	Outlet Average Concentration (ppm)[1]	Outlet Average Mass Flow rate (lb/min) ≤	Control Efficiency ≥
1	37.98	0.03448	ND	0.00011	99.3677%
2	67.42	0.06097	ND	0.00011	99.4900%
3	53.21	0.04799	ND	0.00011	99.6590%

Control Efficiency ≥ **99.5056%**

Efficiency = (MassFlowin - MassFlowout / MassFlowin)(100)
Mass Flow (lb/min) = (VolFlow)(MolWt)(C /$10^{6)}$/(MolVol)

MW EtO = 44.05
MolVol = 385.32
C = Dry Concentration
[1] ND = Non Detect. Detection limit of the GC was determined to be 0.1 ppm

	INLET		OUTLET	
	Average Temperature (°F)	**Moisture Content (%)**	**Average Temperature (°F)**	**Moisture Content (%)**
Run 1	101.8	6.9834	101.8	6.9811
Run 2	103.1	7.2783	103.1	7.2607
Run3	104.1	7.4843	104.1	7.4811

TABLE 2 - ETHYLENE OXIDE CONTROL EFFICIENCY – BACKVENT
STERIGENICS - WILLOWBROOK, ILLINOIS (PLANT 2)
SEPTEMBER 20, 2018

		INLET ETO				OUTLET ETO				
Run #	Time	Wet Concentration (PPM)[1]	Dry Concentration (PPM)[1]	Dry Volumetric Flow	Mass Flow[3] (lb/min)	Wet Concentration (PPM)[1,2]	Dry Concentration (PPM)[1,2]	Dry Volumetric Flow	Mass Flow[3] (lb/min) ≤	Control Efficiency[4] ≥
1	1539	7.94	8.5	7940.8	0.00775	ND	ND	8943.3	0.0001099	98.5816%
1	1540	8.41	9.0	7940.8	0.00821	ND	ND	8943.3	0.0001099	98.6608%
1	1541	213.00	229.0	7940.8	0.20788	ND	ND	8943.3	0.0001099	99.9471%
1	1542	30.40	32.7	7940.8	0.02967	ND	ND	8943.3	0.0001099	99.6295%
1	1544	22.30	24.0	7940.8	0.02176	ND	ND	8943.3	0.0001099	99.4950%
1	1545	22.20	23.9	7940.8	0.02167	ND	ND	8943.3	0.0001099	99.4927%
1	1546	21.80	23.4	7940.8	0.02128	ND	ND	8943.3	0.0001099	99.4834%
1	1547	19.70	21.2	7940.8	0.01923	ND	ND	8943.3	0.0001099	99.4283%
1	1548	18.80	20.2	7940.8	0.01835	ND	ND	8943.3	0.0001099	99.4009%
1	1549	20.30	21.8	7940.8	0.01981	ND	ND	8943.3	0.0001099	99.4452%
1	1550	19.30	20.7	7940.8	0.01884	ND	ND	8943.3	0.0001099	99.4165%
1	1552	19.80	21.3	7940.8	0.01932	ND	ND	8943.3	0.0001099	99.4312%
2	1617	13.00	14.0	7910.4	0.01268	ND	ND	8910.8	0.0001098	99.1336%
2	1618	545.00	587.8	7910.4	0.53154	ND	ND	8910.8	0.0001098	99.9793%
2	1619	50.00	53.9	7910.4	0.04877	ND	ND	8910.8	0.0001098	99.7747%
2	1620	22.00	23.7	7910.4	0.02146	ND	ND	8910.8	0.0001098	99.4881%
2	1621	22.80	24.6	7910.4	0.02224	ND	ND	8910.8	0.0001098	99.5060%
2	1622	19.70	21.2	7910.4	0.01921	ND	ND	8910.8	0.0001098	99.4283%
2	1623	20.00	21.6	7910.4	0.01951	ND	ND	8910.8	0.0001098	99.4369%
2	1625	20.50	22.1	7910.4	0.01999	ND	ND	8910.8	0.0001098	99.4506%
2	1626	19.80	21.4	7910.4	0.01931	ND	ND	8910.8	0.0001098	99.4312%
2	1627	19.50	21.0	7910.4	0.01902	ND	ND	8910.8	0.0001098	99.4224%
2	1628	21.30	23.0	7910.4	0.02077	ND	ND	8910.8	0.0001098	99.4712%
2	1629	19.40	20.9	7910.4	0.01892	ND	ND	8910.8	0.0001098	99.4195%
2	1630	19.70	21.2	7910.4	0.01921	ND	ND	8910.8	0.0001098	99.4283%
3	1651	20.60	22.3	7889.3	0.02008	ND	ND	8885.5	0.0001098	99.4533%
3	1652	246.00	265.9	7889.3	0.23982	ND	ND	8885.5	0.0001098	99.9542%
3	1653	40.10	43.3	7889.3	0.03909	ND	ND	8885.5	0.0001098	99.7191%
3	1654	34.20	37.0	7889.3	0.03334	ND	ND	8885.5	0.0001098	99.6707%
3	1655	30.80	33.3	7889.3	0.03003	ND	ND	8885.5	0.0001098	99.6343%
3	1657	31.60	34.2	7889.3	0.03081	ND	ND	8885.5	0.0001098	99.6436%
3	1658	33.10	35.8	7889.3	0.03227	ND	ND	8885.5	0.0001098	99.6597%
3	1659	31.50	34.0	7889.3	0.03071	ND	ND	8885.5	0.0001098	99.6425%
3	1700	31.80	34.4	7889.3	0.03100	ND	ND	8885.5	0.0001098	99.6458%
3	1701	29.40	31.8	7889.3	0.02866	ND	ND	8885.5	0.0001098	99.6169%
3	1703	31.50	34.0	7889.3	0.03071	ND	ND	8885.5	0.0001098	99.6425%
3	1704	30.10	32.5	7889.3	0.02934	ND	ND	8885.5	0.0001098	99.6258%

Notes:

[1] PPM = parts per million by volume

[2] ND = Non detect. Detection limit of the GC was determined to be 0.10 ppm.

[3] See Table 1 for Mass Flow Calculation

[4] See Table 1 for control efficiency calculation

Efficiency = (MassFlowin - MassFlowout / MassFlowin)(100)

Flow (lb/min) = (VolFlow)(MolWt)(C /10^6)/(MolVol)

APPENDICES

ECSi

APPENDIX A

Process Parameter Logs

ECSi

PROCESS PARAMETER LOG FOR EACH TRIAL

DATE: 20 SEP 2018

SITE AAT TESTED (circle one): Willowbrook I Willowbrook II

Chamber Backvent Tested:	J – 3 pallet chamber w/10 pallets	
Chamber Running Cycle Number:	829	
Parameter	START (Data and Time)	FINISH (Data and Time)
Backvent Opening Time	4:50 pm	5:05
Levels From Aeration	not recorded	not recorded
Ending Chamber EO Concentration	480 ppm EO	

	Beginning (Time)	Middle (Time)	End (Time)
Heated Lines Temp Check Include Temp Units	230F / 230 F	230 F / 230 F	230F / 230F
	4:50pm	4:57 pm	5:05 pm

PROCESS PARAMETER LOG FOR EACH TRIAL

DATE: 20 SEP 2018

SITE AAT TESTED (circle one): Willowbrook I Willowbrook II

Chamber Backvent Tested:	K – 13 pallet chamber w/ 10 pallets	
Chamber Running Cycle Number:	829	
Parameter	START (Data and Time)	FINISH (Data and Time)
Backvent Opening Time	4:16 pm	4:31
Levels From Aeration	not collected	not collected
Ending Chamber EO Concentration	6900 ppm EO	

	Beginning (Time)	Middle (Time)	End (Time)
Heated Lines Temp Check Include Temp Units	230 F / 231 F	230 F / 230 F	230°F / 230°F
	4:15 pm	4:23 pm	4:32

PROCESS PARAMETER LOG FOR EACH TRIAL

DATE: 20 SEP 2018

SITE AAT TESTED (circle one): Willowbrook I Willowbrook II

Chamber Backvent Tested:	G – 13 pallet chamber - w/ 10 pallets	
Chamber Running Cycle Number:	829	
Parameter	START (Data and Time)	FINISH (Data and Time)
Backvent Opening Time	3:38 pm ~~3:07 pm~~	3:53 pm
Levels From Aeration	8.3 ppm 3:07 pm (inlet) 10.0 3:13 pm	not taken
Ending Chamber EO Concentration	600 ppm EO	

	Beginning (Time)	Middle (Time)	End (Time)
Heated Lines Temp Check Include Temp Units	230 F/230 F	230 F / 230 F	230 F / 230 F
	3:07 pm	3:50 pm	3:53 pm

PROCESS PARAMETER LOG FOR EACH SET OF TRIALS

Circle One: Willowbrook 1 AAT Willowbrook 2 AAT

0515 PM

Parameter	BEFORE (Time) 1230 PM	AFTER (Time) 1715
AAT Tank Level (inches)	193" NZ 20SEP18	193" NZ 20SEP18
AAT Liquor pH	0.77 NZ 20SEP18	0.78 NZ 20SEP18
AAT Liquor Glycol %	43.2 % NZ 20SEP18	43.4 % NZ 20SEP18

Samples collected by: NICK ZIELINSKI

Signature: [signature]

DATE: 20SEP18

PLEASE ATTACH TODAY'S METEOROLOGICAL DATA TO THESE TEST RECORDS

APPENDIX B

Method 1 Calculation

WB Sample Port Locations	Duct Size/Configuration	Length (Diameter)	Width	Diameter (Eq. Diameter)		Distance from/to Disturbance	Diameters from/to Disturbance	2D or greater downstream?	0.5D or greater upstream?
WB I Inlet	36" round	36		36	Downstream	78	2.2	YES	
				36	Upstream	44	1.2		YES
WB I Outlet	30" x 20" rectangula	30	20	24	Downstream	60	2.5	YES	
				24	Upstream	84	3.5		YES
WB II Inlet	28" round	28		28	Downstream	108	3.9	YES	
				28	Upstream	96	3.4		YES
WB II Outlet	28" square	28	28	28	Downstream	56	2.0	YES	
				28	Upstream	170	6.1		YES

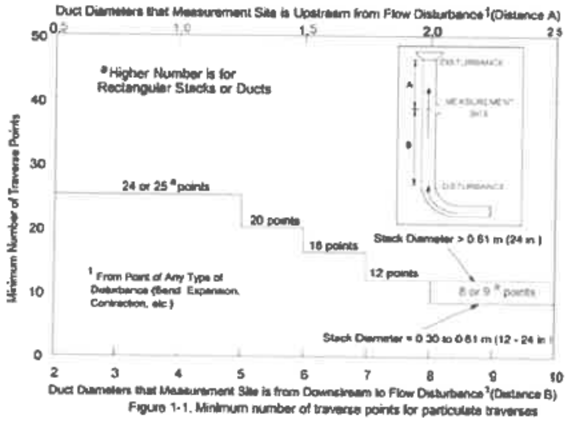


Figure 1-1. Minimum number of traverse points for particulate traverses

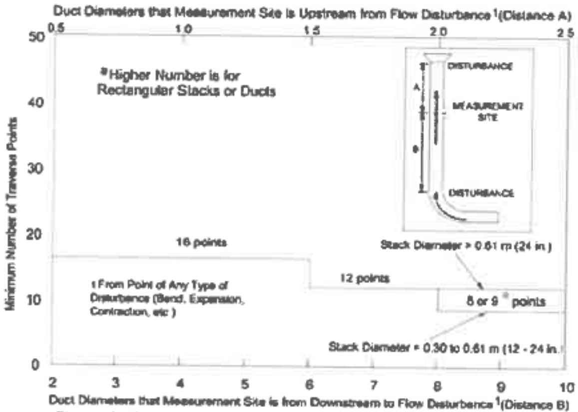


Figure 1-2. Minimum number of traverse points for velocity (nonparticulate) traverses

$$D_e = \frac{2(L)(W)}{L+W}$$

Willowbrook II AAT Inlet Duct Sampling Location

Photo Description – Photo taken in WB2 AAT Room, looking towards roof near room entrance. North is towards bottom of photo, and AAT control device is to the left.

Willowbrook II Inlet Duct Sampling Duct Location Diagram

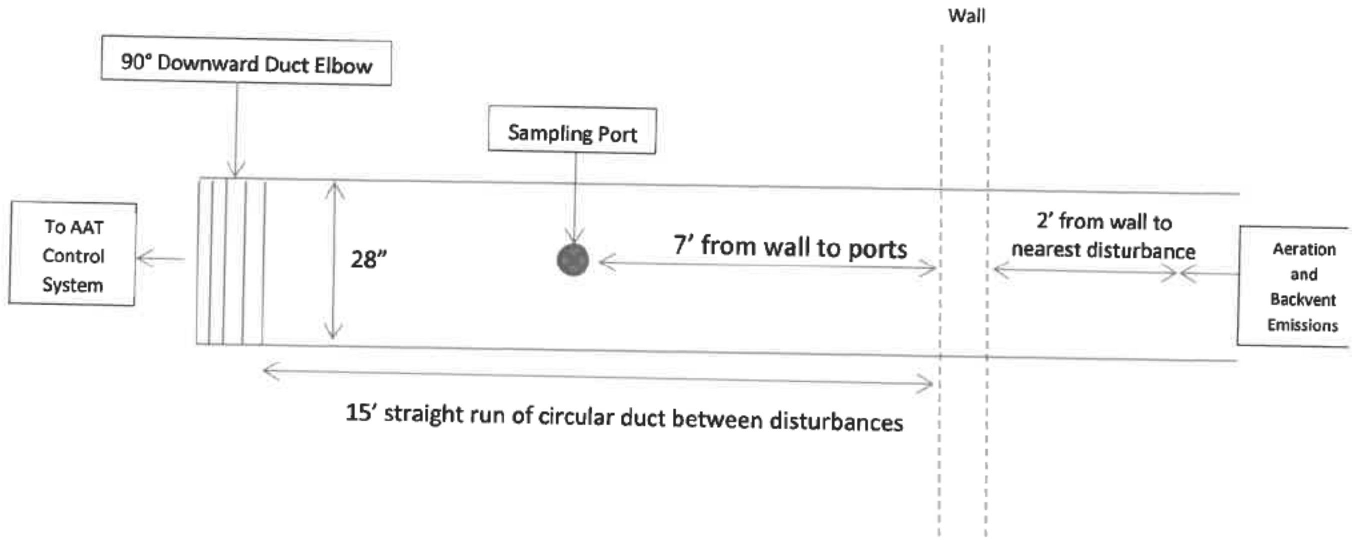
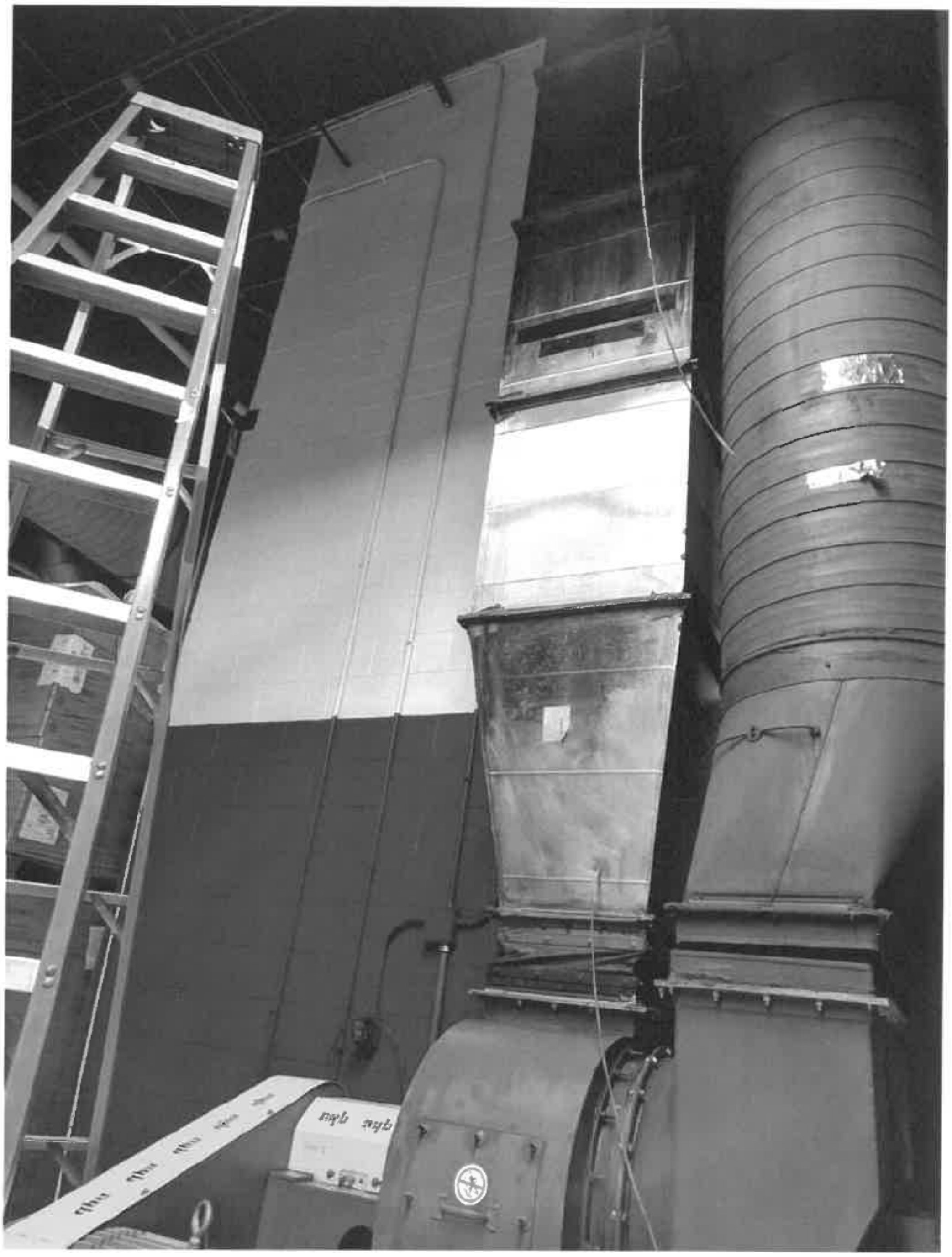


Diagram Description – Diagram depicts inlet duct configuration seen in photo, looking upward towards roof. All ducting in diagram has a 28" circular diameter. Sampling port depicted faces AAT Scrubber Room floor. An additional port will be located on the duct 90° from depicted port.

Willowbrook 2 AAT Outlet Duct Sampling Location

Photo Description – Photo taken in WB2 AAT Drybed Room, looking Southeast. Duct is square until it transitions near the roofline. Each pictured segment of straight duct is 34" in length.



Willowbrook II Outlet Sampling Duct Location Diagram

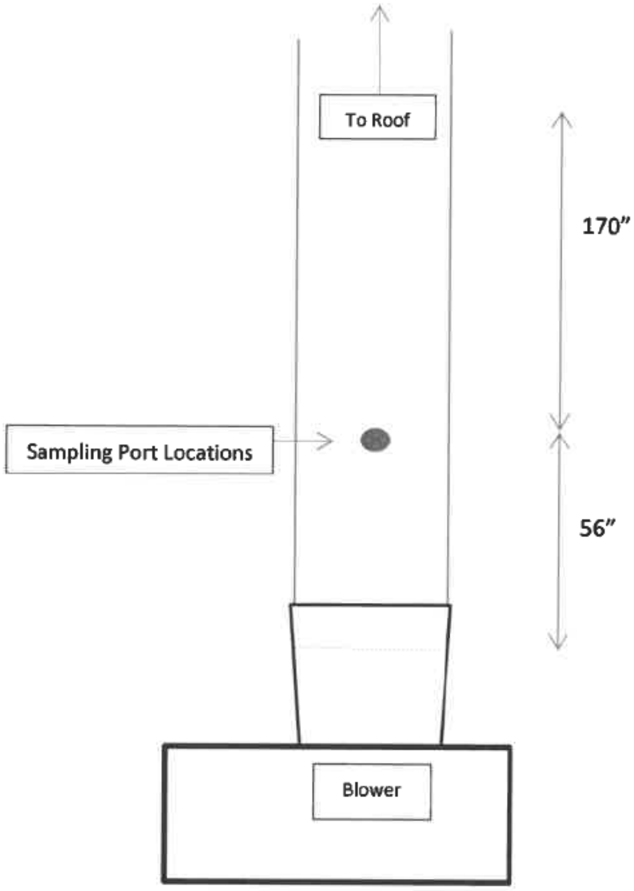


Diagram Description – Diagram depicts outlet duct sampling configuration in AAT Drybed Room seen in photo, with a slightly more perpendicular view to the duct, towards the south. The main run of ducting where the samples will be obtained is a 28" square duct. 56" and 170" are measurements to nearest duct disturbances.

APPENDIX C

Method 2 Calculation

ECSi

ECSi, Inc.

Volumetric Flow Calculation - AAT Inlet

Sterigenics US, LLC - Willowbrook, IL (Plant 2)
9/20/2018

Data from Traverse Table				Constants	
Average SQRT(Δp)	0.6119	from Traverse Table	**MW dry =**	29.00	
Temp	94.9	°F	**stack diameter =**	28	in.
	555	°R	**stack area =**	4.28	sq. ft.
			Tstd =	528	
			Pstd =	29.92	
Moisture Content	5.68%		**Cp =**	0.84	
Ms	28.38	molecular weight of stack gas	**Kp =**	85.49	
Pb	29.15	Barometric pressure			
Pg	-0.35	Stack static pressure			
Ps	29.12	Absolute stack pressure			

Stack Velocity (Vs) = 36.0 ft/sec

$$V_s = K_p\, C_p \left[\frac{\sum_{i=1}^{n} \sqrt{\Delta\, p_i}}{n} \right] \sqrt{\frac{T_{s(abavg)}}{P_s\; M_s}}$$

Stack Flow (inlet)= 9239 acf/min

$Q_{actual} = 60 * V_s * A_s$

Stack Flow (inlet) = 8071 dscfm

$$Q = 60\,(1 - B_{ws})\, V_s\, A \left| \frac{T_{std}\, P_s}{T_{s(abavg)}\, P_{std}} \right|$$

ECSi, Inc.

Volumetric Flow Calculation - AAT Outlet

Sterigenics US, LLC. - Willowbrook, IL (Plant 2)
9/20/2018

Data from Traverse Table

Average SQRT(Δp)	0.5421	from Traverse Table
Temp	101.7	°F
	562	°R
Moisture Content	7.03%	
Ms	28.23	molecular weight of stack gas
Pb	29.15	Barometric pressure
Pg	0.1	Stack static pressure
Ps	29.16	Absolute stack pressure

Constants

MW dry =	29.00	
stack ID =	28x28	in.
stack area =	5.44	sq. ft.
Tstd =	528	
Pstd =	29.92	
Cp =	0.84	
Kp =	85.49	

Stack Velocity (Vs) = 32.2 ft/sec

$$V_s = K_p \, C_p \left[\frac{\sum_{i=1}^{n} \sqrt{\Delta \, p_i}}{n} \right] \sqrt{\frac{T_{s\,(abavg)}}{P_s \;\; M_s}}$$

Stack Flow (outlet)= 10506 acf/min

$Q_{actual} = 60 {*} V_s {*} A_s$

Stack Flow (outlet) = 8947 dscfm

$$Q = 60\,(1 - B_{ws})\, V_s\, A \left| \frac{T_{std} P_s}{T_{s(abavg)} P_{std}} \right|$$

ECSI, INC. - VELOCITY TRAVERSE DATA

Client: Sterigenics
Location: Willowbrook - Plant 2
Source: AAT Safe Cell System Inlet

Run #: 1
Probe Type: S
Stack I.D.: 28 in.

Date: 9/20/2018
Baro Press: 29.15

Port Sketch:

	Port 1							Port 2						
		Delta P				Stack	Cyclonic		Delta P				Stack	Cyclonic
Inches From Port	Point#	Low	High	Average	Sq Root	Temp (F)	Angle	Point#	Low	High	Average	Sq Root	Temp (F)	Angle
0.5	1	0.4	0.4	0.4	0.6325	88.2	7.2	1	0.5	0.5	0.5	0.7071	90.4	4.7
1.9	2	0.25	0.25	0.25	0.5000	88.2	6.3	2	0.25	0.25	0.25	0.5000	89.9	5.4
3.3	3	0.2	0.2	0.2	0.4472	88.5	3.4	3	0.3	0.3	0.3	0.5477	93.3	4.8
4.9	4	0.25	0.25	0.25	0.5000	91.2	4.8	4	0.35	0.35	0.35	0.5916	95.4	3.6
7.0	5	0.25	0.25	0.25	0.5000	93.5	3.6	5	0.4	0.4	0.4	0.6325	96.7	3.2
10.0	6	0.35	0.35	0.35	0.5916	95.8	4.7	6	0.45	0.45	0.45	0.6708	97.4	2.1
18.0	7	0.45	0.45	0.45	0.6708	95.6	3.8	7	0.45	0.45	0.45	0.6708	96.7	4.8
21.0	8	0.45	0.45	0.45	0.6708	95.7	3.7	8	0.47	0.47	0.47	0.6856	97.6	3.9
23.1	9	0.45	0.45	0.45	0.6708	97.4	5.1	9	0.4	0.45	0.425	0.6519	98.0	5.1
24.7	10	0.45	0.45	0.45	0.6708	97.9	4.5	10	0.45	0.45	0.45	0.6708	98.4	5.4
26.1	11	0.45	0.45	0.45	0.6708	98.2	3.6	11	0.48	0.48	0.48	0.6928	98.4	3.8
27.5	12	0.3	0.3	0.3	0.5477	97.4	2.2	12	0.35	0.35	0.35	0.5916	98.3	2.0
	13							13						
	14							14						
	15							15						
	16							16						
	17							17						
	18							18						
	19							19						
	20							20						
	21							21						
	22							22						
	23							23						
	24							24						
										Average Values:	0.3802	0.6119	94.9	4.2

ECSI, INC. - VELOCITY TRAVERSE DATA

Client: Sterigenics
Location: Willowbrook - Plant 2
Source: AAT Safe Cell System Outlet

Run #: 1 | Date: 9/20/2018 | Port Sketch:
Probe Type: S | Baro Press: 29.15
Stack I.D.: 28x28

	Port 1 & 2							Port 3 & 4						
Inches		Delta P				Stack	Cyclonic		Delta P				Stack	Cyclonic
From Port	Point#	Low	High	Average	Sq Root	Temp (F)	Angle	Point#	Low	High	Average	Sq Root	Temp (F)	Angle
3.5	1	0.5	0.5	0.5	0.7071	101	3.9	1	0.3	0.3	0.3	0.5477	100	4.4
7.0	2	0.55	0.55	0.55	0.7416	102	3.9	2	0.25	0.25	0.25	0.5000	102	5.4
10.5	3	0.6	0.6	0.6	0.7746	102	2.6	3	0.25	0.25	0.25	0.5000	102	5.6
14.0	4	0.6	0.6	0.6	0.7746	102	2.6	4	0.2	0.2	0.2	0.4472	102	3.1
17.5	5	0.55	0.55	0.55	0.7416	102	2.5	5	0.15	0.15	0.15	0.3873	102	1.8
21.0	6	0.6	0.6	0.6	0.7746	102	2.1	6	0.2	0.2	0.2	0.4472	102	2.5
24.5	7	0.6	0.6	0.6	0.7746	102	3.8	7	0.2	0.2	0.2	0.4472	102	2.0
3.5	1	0.4	0.4	0.4	0.6325	99.4	1.1	1	0.15	0.15	0.15	0.3873	101	4.2
7.0	2	0.4	0.4	0.4	0.6325	101	6.2	2	0.15	0.15	0.15	0.3873	102	5.0
10.5	3	0.4	0.4	0.4	0.6325	102	2.0	3	0.1	0.1	0.1	0.3162	102	1.2
14.0	4	0.3	0.3	0.3	0.5477	102	4.4	4	0.1	0.1	0.1	0.3162	102	4.7
17.5	5	0.3	0.3	0.3	0.5477	102	4.7	5	0.1	0.1	0.1	0.3162	102	1.8
21.0	6	0.4	0.4	0.4	0.6325	102	5.1	6	0.1	0.1	0.1	0.3162	102	0.8
24.5	7	0.4	0.4	0.4	0.6325	102	4.6	7	0.1	0.1	0.1	0.3162	102	2.5
										Average Values:	0.3196	0.5421	101.7	3.4

APPENDIX D

Method 4 Calculation

ECSi

Sterigenics - Willowbrook 2 - AAT Inlet
9/20/2018

Saturate Moisture Content (%)

$$B_{ws(svp)}(\%) = 100\left(\frac{10^{\left(6.691-\left(\frac{3144}{T_{s(avg)}+390.86}\right)\right)}}{\left(P_b + \frac{P_{static}}{13.6}\right)}\right)$$

Ts	94.9	stack temperature (F)
Pb	29.15	barametreric pressure (in Hg)
ps	-0.35	static pressure of stack (in H2O)

Bws(svp) = 5.68 %

Sterigenics - Willowbrook 2 - AAT Outlet
9/20/2018

Saturate Moisture Content (%)

$$B_{ws(svp)}(\%) = 100\left(\frac{10^{\left(6.691-\left(\frac{3144}{T_{s(avg)}+390.86}\right)\right)}}{\left(P_b + \frac{P_{static}}{13.6}\right)}\right)$$

Ts	102	stack temperature (F)
Pb	29.15	barametreric pressure (in Hg)
ps	0.1	static pressure of stack (in H2O)

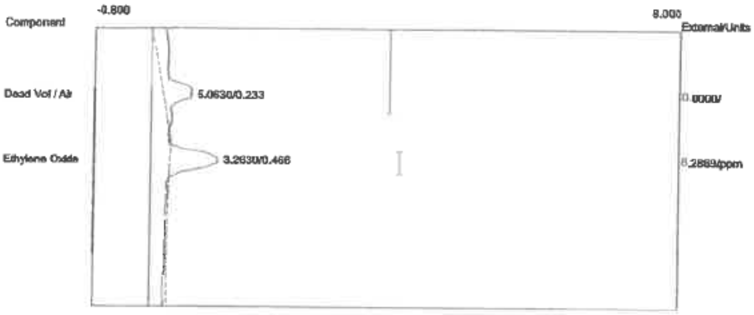
Bws(svp) = 7.03 %

APPENDIX E

Chromatograms - Backvent

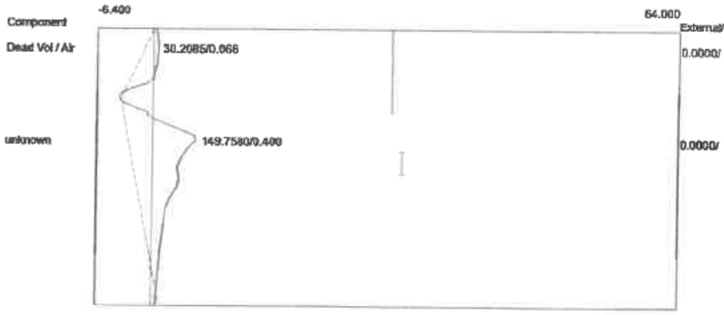
ECSi

Lab name: ECSi
Client: Sterigenics - Willowbrook 2
Client ID: Aeration
Analysis date: 09/20/2018 15:09:28
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1Ster2WB2018-A01.CHR (c:\peak359)
Sample: AAT Inlet
Operator: D. Kremer



Component	Retention	Area	External	Units
Dead Vol / Air	0.233	5.0630	0.0000	
Ethylene Oxide	0.466	3.2630	8.2869	ppm
		8.3260	8.2869	

Lab name: ECSi
Client: Sterigenics - Willowbrook 2
Client ID: Aeration
Analysis date: 09/20/2018 15:11:37
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2Ster2WB2018-A02.CHR (c:\peak359)
Sample: AAT Outlet
Operator: D. Kremer

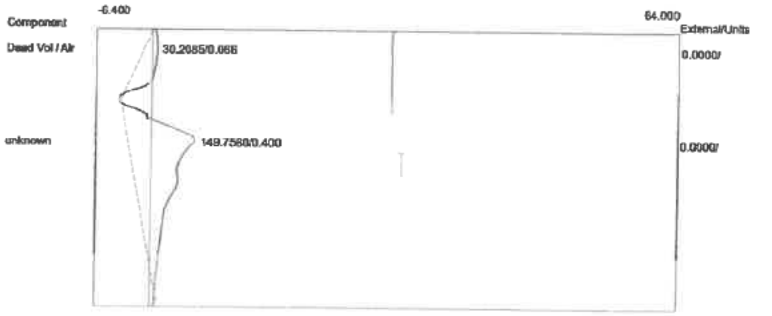


Component	Retention	Area	External	Units
Dead Vol / Air	0.066	30.2085	0.0000	
		30.2085	0.0000	

Lab name: ECSi
Client: Sterigenics - Willowbrook 2
Client ID: Aeration
Analysis date: 09/20/2018 15:11:37
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1Ster2WB2018-A02.CHR (c:\peak359)
Sample: AAT Inlet
Operator: D. Kremer

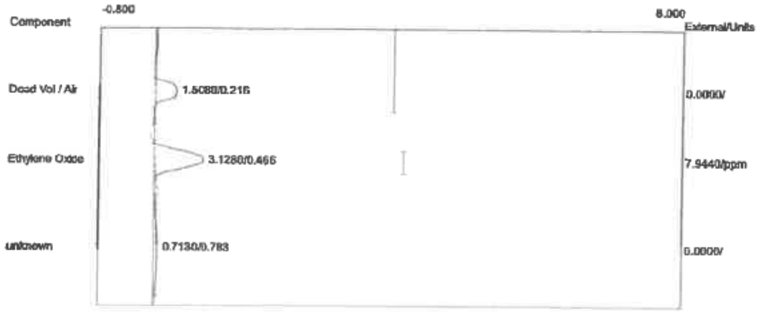
Component	Retention	Area	External	Units
Dead Vol / Air	0.233	1.8040	0.0000	
Ethylene Oxide	0.483	4.1625	10.5713	ppm
		5.9665	10.5713	

Lab name: ECSi
Client: Sterigenics - Willowbrook 2
Client ID: Aeration
Analysis date: 09/20/2018 15:11:37
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2Ster2WB2018-A02.CHR (c:\peak359)
Sample: AAT Outlet
Operator: D. Kremer



Component	Retention	Area	External	Units
Dead Vol / Air	0.066	30.2085	0.0000	
		30.2085	0.0000	

Lab name: ECSi
Client: Sterigenics - Willowbrook 2
Client ID: Run#1BV
Analysis date: 09/20/2018 15:39:20
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1Ster2WB2018-1B01.CHR (c:\peak359)
Sample: AAT Inlet
Operator: D. Kremer

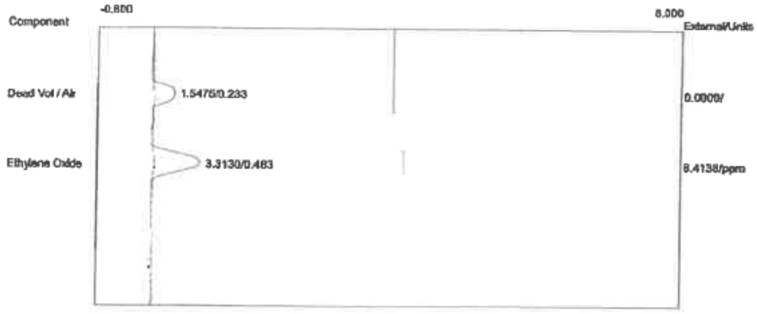


Component	Retention	Area	External	Units
Dead Vol / Air	0.216	1.5080	0.0000	
Ethylene Oxide	0.466	3.1280	7.9440	ppm
		4.6360	7.9440	

Lab name: ECSi
Client: Sterigenics - Willowbrook 2
Client ID: Run#1BV
Analysis date: 09/20/2018 15:39:20
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2Ster2WB2018-1B01.CHR (c:\peak359)
Sample: AAT Outlet
Operator: D. Kremer

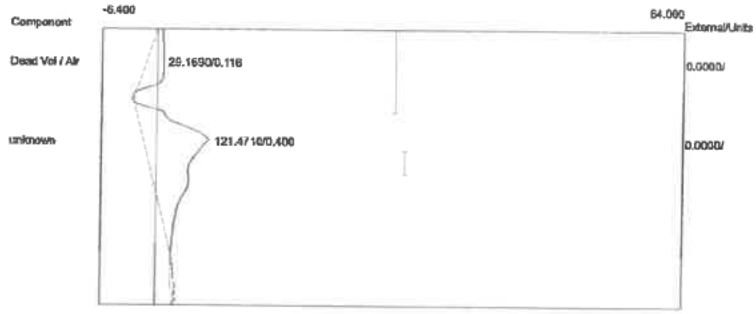
Component	Retention	Area	External	Units
Dead Vol / Air	0.083	19.0885	0.0000	
		19.0885	0.0000	

Lab name: ECSi
Client: Sterigenics - Willowbrook 2
Client ID: Run#1BV
Analysis date: 09/20/2018 15:40:32
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1Ster2WB2018-1B02.CHR (c:\peak359)
Sample: AAT Inlet
Operator: D. Kremer



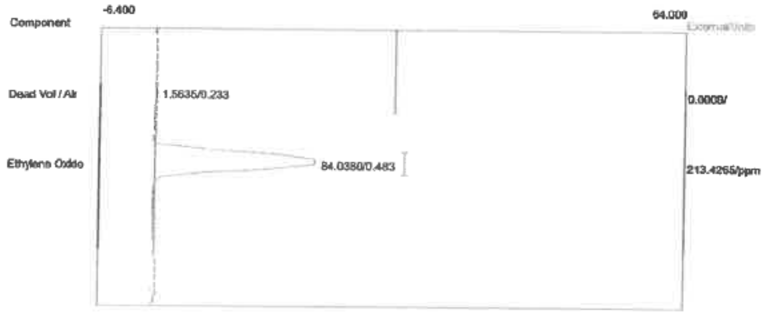
Component	Retention	Area	External	Units
Dead Vol / Air	0.233	1.5475	0.0000	
Ethylene Oxide	0.483	3.3130	8.4138	ppm
		4.8605	8.4138	

Lab name: ECSi
Client: Sterigenics - Willowbrook 2
Client ID: Run#1BV
Analysis date: 09/20/2018 15:40:32
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2Ster2WB2018-1B02.CHR (c:\peak359)
Sample: AAT Outlet
Operator: D. Kremer



Component	Retention	Area	External	Units
Dead Vol / Air	0.116	29.1690	0.0000	
		29.1690	0.0000	

Lab name: ECSi
Client: Sterigenics - Willowbrook 2
Client ID: Run#1BV
Analysis date: 09/20/2018 15:41:42
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1Ster2WB2018-1B03.CHR (c:\peak359)
Sample: AAT Inlet
Operator: D. Kremer

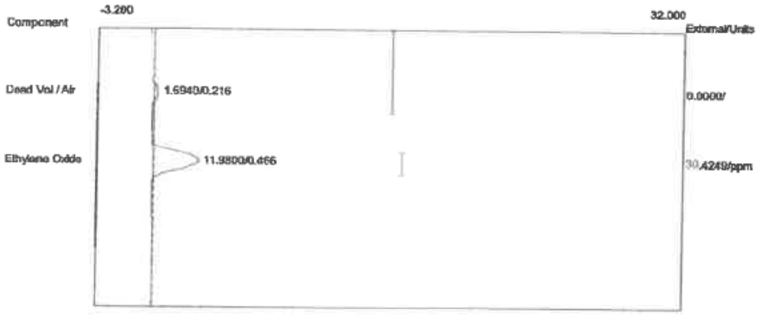


Component	Retention	Area	External	Units
Dead Vol / Air	0.233	1.5635	0.0000	
Ethylene Oxide	0.483	84.0380	213.4265	ppm
		85.6015	213.4265	

Lab name: ECSi
Client: Sterigenics - Willowbrook 2
Client ID: Run#1BV
Analysis date: 09/20/2018 15:41:42
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2Ster2WB2018-1B03.CHR (c:\peak359)
Sample: AAT Outlet
Operator: D. Kremer

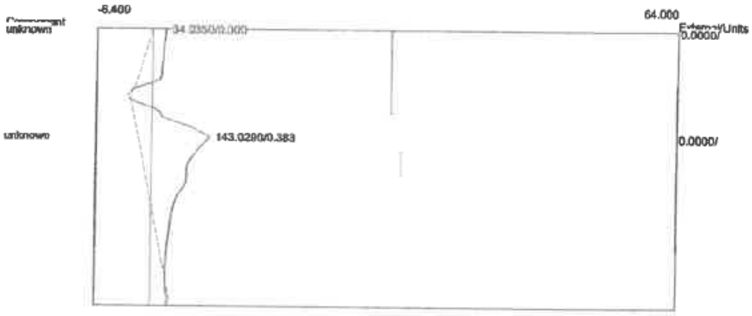
Component	Retention	Area	External	Units
		0.0000	0.0000	

Lab name: ECSi
Client: Sterigenics - Willowbrook 2
Client ID: Run#1BV
Analysis date: 09/20/2018 15:42:51
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1Ster2WB2018-1B04.CHR (c:\peak359)
Sample: AAT Inlet
Operator: D. Kremer



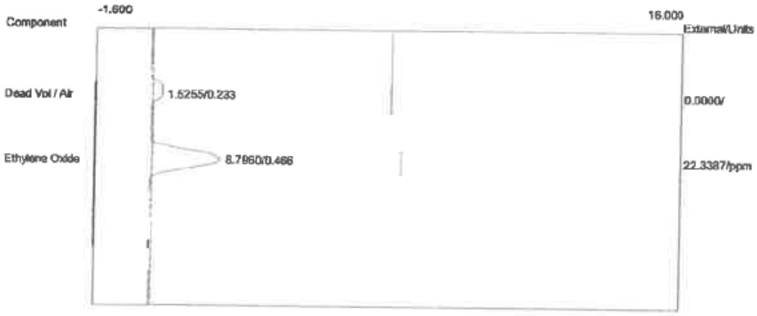
Component	Retention	Area	External	Units
Dead Vol / Air	0.216	1.6940	0.0000	
Ethylene Oxide	0.466	11.9800	30.4249	ppm
		13.6740	30.4249	

Lab name: ECSi
Client: Sterigenics - Willowbrook 2
Client ID: Run#1BV
Analysis date: 09/20/2018 15:42:51
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2Ster2WB2018-1B04.CHR (c:\peak359)
Sample: AAT Outlet
Operator: D. Kremer



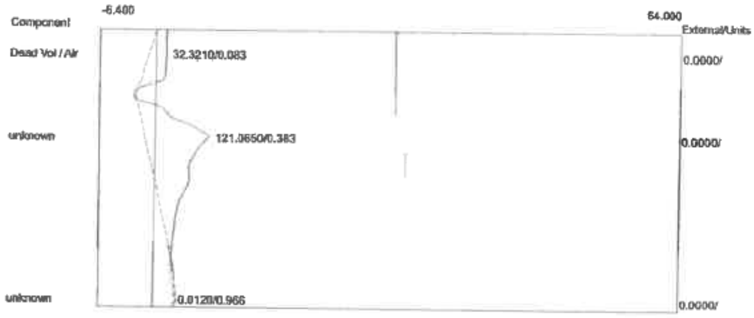
Component	Retention	Area	External	Units
		0.0000	0.0000	

Lab name: ECSi
Client: Sterigenics - Willowbrook 2
Client ID: Run#1BV
Analysis date: 09/20/2018 15:44:03
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1Ster2WB2018-1B05.CHR (c:\peak359)
Sample: AAT Inlet
Operator: D. Kremer



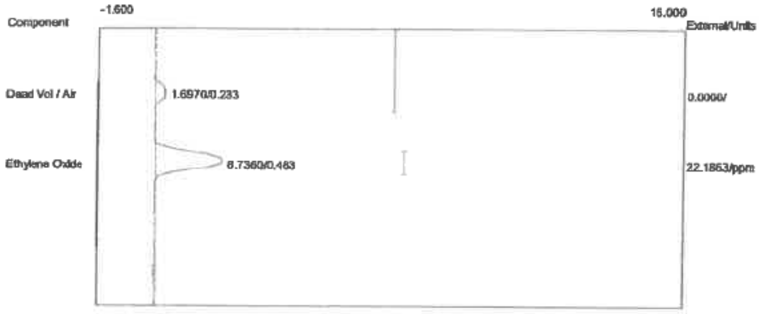
Component	Retention	Area	External	Units
Dead Vol / Air	0.233	1.5255	0.0000	
Ethylene Oxide	0.466	8.7960	22.3387	ppm
		10.3215	22.3387	

Lab name: ECSi
Client: Sterigenics - Willowbrook 2
Client ID: Run#1BV
Analysis date: 09/20/2018 15:44:03
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2Ster2WB2018-1B05.CHR (c:\peak359)
Sample: AAT Outlet
Operator: D. Kremer



Component	Retention	Area	External	Units
Dead Vol / Air	0.083	32.3210	0.0000	
		32.3210	0.0000	

Lab name: ECSi
Client: Sterigenics - Willowbrook 2
Client ID: Run#1BV
Analysis date: 09/20/2018 15:45:12
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1Ster2WB2018-1B06.CHR (c:\peak359)
Sample: AAT Inlet
Operator: D. Kremer



Component	Retention	Area	External	Units
Dead Vol / Air	0.233	1.6970	0.0000	
Ethylene Oxide	0.483	8.7360	22.1863	ppm
		10.4330	22.1863	

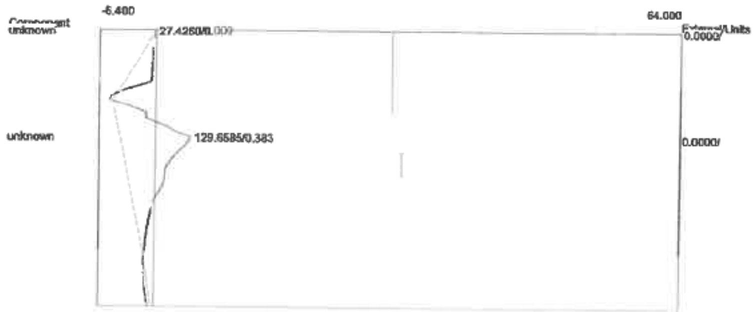
Lab name: ECSi
Client: Sterigenics - Willowbrook 2
Client ID: Run#1BV
Analysis date: 09/20/2018 15:45:12
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2Ster2WB2018-1B06.CHR (c:\peak359)
Sample: AAT Outlet
Operator: D. Kremer

Component	Retention	Area	External	Units
Dead Vol / Air	0.016	18.9630	0.0000	
		18.9630	0.0000	

Lab name: ECSi
Client: Sterigenics - Willowbrook 2
Client ID: Run#1BV
Analysis date: 09/20/2018 15:46:20
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1Ster2WB2018-1B07.CHR (c:\peak359)
Sample: AAT Inlet
Operator: D. Kremer

Component	Retention	Area	External	Units
Dead Vol / Air	0.233	1.2640	0.0000	
Ethylene Oxide	0.483	8.5770	21.7825	ppm
		9.8410	21.7825	

Lab name: ECSi
Client: Sterigenics - Willowbrook 2
Client ID: Run#1BV
Analysis date: 09/20/2018 15:46:20
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2Ster2WB2018-1B07.CHR (c:\peak359)
Sample: AAT Outlet
Operator: D. Kremer



Component	Retention	Area	External	Units
		0.0000	0.0000	

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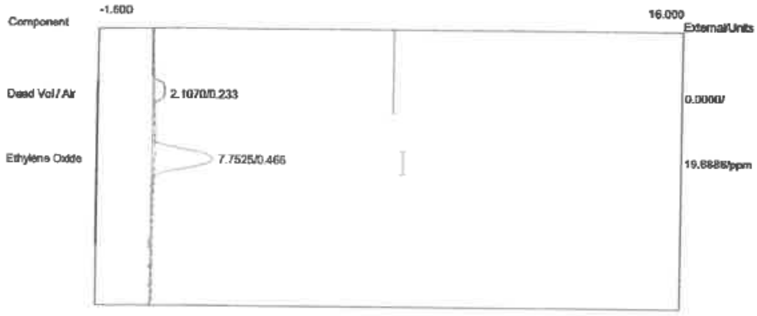
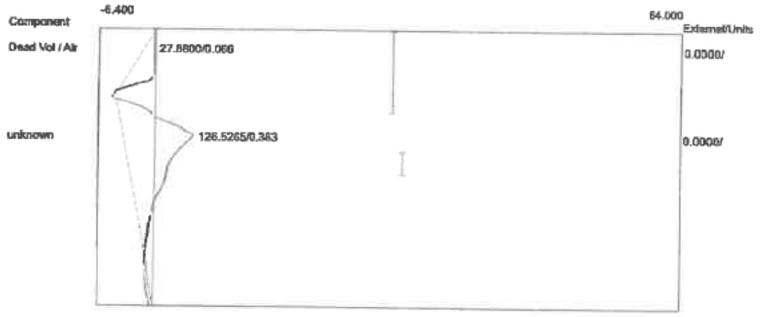
Lab name: ECSi
Client: Sterigenics - Willowbrook 2
Client ID: Run#1BV
Analysis date: 09/20/2018 15:47:29
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1Ster2WB2018-1B08.CHR (c:\peak359)
Sample: AAT Inlet
Operator: D. Kremer



Component	Retention	Area	External	Units
Dead Vol / Air	0.233	2.1070	0.0000	
Ethylene Oxide	0.466	7.7525	19.6886	ppm
		9.8595	19.6886	

Lab name: ECSi
Client: Sterigenics - Willowbrook 2
Client ID: Run#1BV
Analysis date: 09/20/2018 15:47:29
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2Ster2WB2018-1B08.CHR (c:\peak359)
Sample: AAT Outlet
Operator: D. Kremer



Component	Retention	Area	External	Units
Dead Vol / Air	0.066	27.8800	0.0000	
		27.8800	0.0000	

Lab name: ECSi
Client: Sterigenics - Willowbrook 2
Client ID: Run#1BV
Analysis date: 09/20/2018 15:48:40
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1Ster2WB2018-1B09.CHR (c:\peak359)
Sample: AAT Inlet
Operator: D. Kremer

Component	Retention	Area	External	Units
Dead Vol / Air	0.233	1.8140	0.0000	
Ethylene Oxide	0.466	7.3910	18.7705	ppm
		9.2050	18.7705	

Lab name: ECSi
Client: Sterigenics - Willowbrook 2
Client ID: Run#1BV
Analysis date: 09/20/2018 15:48:40
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2Ster2WB2018-1B09.CHR (c:\peak359)
Sample: AAT Outlet
Operator: D. Kremer

Component	Retention	Area	External	Units
Dead Vol / Air	0.066	26.4320	0.0000	
		26.4320	0.0000	

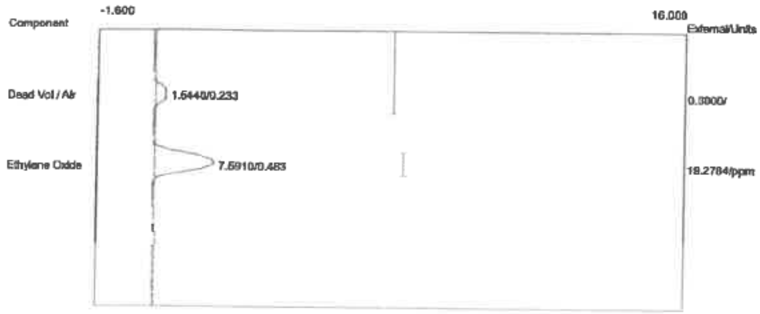
Lab name: ECSi
Client: Sterigenics - Willowbrook 2
Client ID: Run#1BV
Analysis date: 09/20/2018 15:49:48
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1Ster2WB2018-1B10.CHR (c:\peak359)
Sample: AAT Inlet
Operator: D. Kremer

Component	Retention	Area	External	Units
Dead Vol / Air	0.216	2.0830	0.0000	
Ethylene Oxide	0.466	7.9955	20.3057	ppm
		10.0785	20.3057	

Lab name: ECSi
Client: Sterigenics - Willowbrook 2
Client ID: Run#1BV
Analysis date: 09/20/2018 15:49:48
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2Ster2WB2018-1B10.CHR (c:\peak359)
Sample: AAT Outlet
Operator: D. Kremer

Component	Retention	Area	External	Units
Dead Vol / Air	0.083	28.9990	0.0000	
		28.9990	0.0000	

Lab name: ECSi
Client: Sterigenics - Willowbrook 2
Client ID: Run#1BV
Analysis date: 09/20/2018 15:50:59
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1Ster2WB2018-1B11.CHR (c:\peak359)
Sample: AAT Inlet
Operator: D. Kremer



Component	Retention	Area	External	Units
Dead Vol / Air	0.233	1.5440	0.0000	
Ethylene Oxide	0.483	7.5910	19.2784	ppm
		9.1350	19.2784	

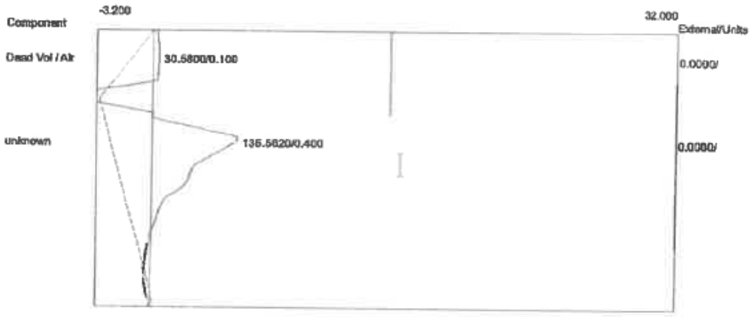
Lab name: ECSi
Client: Sterigenics - Willowbrook 2
Client ID: Run#1BV
Analysis date: 09/20/2018 15:50:59
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2Ster2WB2018-1B11.CHR (c:\peak359)
Sample: AAT Outlet
Operator: D. Kremer

Component	Retention	Area	External	Units
Dead Vol / Air	0.100	28.9185	0.0000	
		28.9185	0.0000	

Lab name: ECSi
Client: Sterigenics - Willowbrook 2
Client ID: Run#1BV
Analysis date: 09/20/2018 15:52:07
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1Ster2WB2018-1B12.CHR (c:\peak359)
Sample: AAT Inlet
Operator: D. Kremer

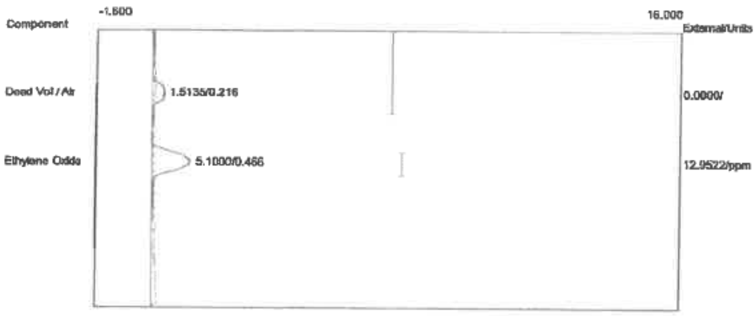
Component	Retention	Area	External	Units
Dead Vol / Air	0.233	1.2875	0.0000	
Ethylene Oxide	0.483	7.7790	19.7559	ppm
		9.0665	19.7559	

Lab name: ECSi
Client: Sterigenics - Willowbrook 2
Client ID: Run#1BV
Analysis date: 09/20/2018 15:52:07
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2Ster2WB2018-1B12.CHR (c:\peak359)
Sample: AAT Outlet
Operator: D. Kremer



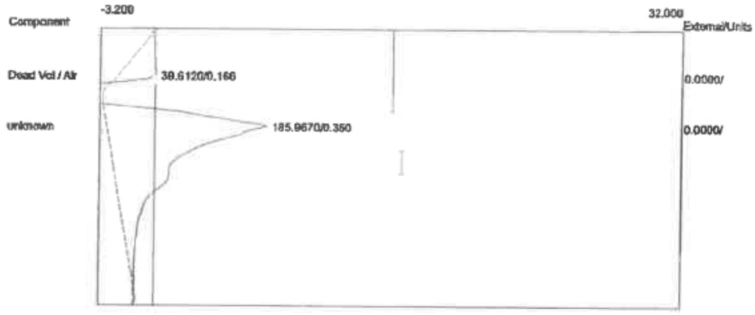
Component	Retention	Area	External	Units
Dead Vol / Air	0.100	30.5800	0.0000	
		30.5800	0.0000	

Lab name: ECSi
Client: Sterigenics - Willowbrook 2
Client ID: Run#2BV
Analysis date: 09/20/2018 16:17:00
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1Ster2WB2018-2B01.CHR (c:\peak359)
Sample: AAT Inlet
Operator: D. Kremer



Component	Retention	Area	External	Units
Dead Vol / Air	0.216	1.5135	0.0000	
Ethylene Oxide	0.466	5.1000	12.9522	ppm
		6.6135	12.9522	

Lab name: ECSi
Client: Sterigenics - Willowbrook 2
Client ID: Run#2BV
Analysis date: 09/20/2018 16:17:00
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2Ster2WB2018-2B01.CHR (c:\peak359)
Sample: AAT Outlet
Operator: D. Kremer

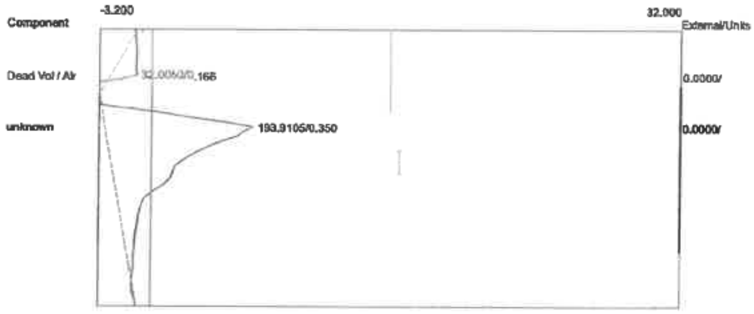


Component	Retention	Area	External	Units
Dead Vol / Air	0.166	39.6120	0.0000	
		39.6120	0.0000	

Lab name: ECSi
Client: Sterigenics - Willowbrook 2
Client ID: Run#2BV
Analysis date: 09/20/2018 16:18:06
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1Ster2WB2018-2B02.CHR (c:\peak359)
Sample: AAT Inlet
Operator: D. Kremer

Component	Retention	Area	External	Units
Dead Vol / Air	0.216	3.5860	0.0000	
Ethylene Oxide	0.466	214.4160	544.5400	ppm
		218.0020	544.5400	

Lab name: ECSi
Client: Sterigenics - Willowbrook 2
Client ID: Run#2BV
Analysis date: 09/20/2018 16:18:06
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2Ster2WB2018-2B02.CHR (c:\peak359)
Sample: AAT Outlet
Operator: D. Kremer

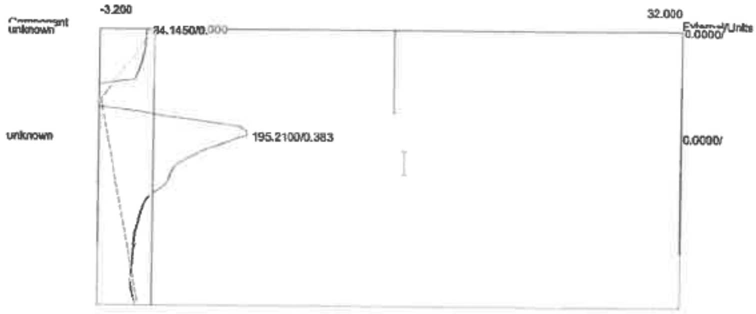


Component	Retention	Area	External	Units
Dead Vol / Air	0.166	32.0050	0.0000	
		32.0050	0.0000	

Lab name: ECSi
Client: Sterigenics - Willowbrook 2
Client ID: Run#2BV
Analysis date: 09/20/2018 16:19:13
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1Ster2WB2018-2B03.CHR (c:\peak359)
Sample: AAT Inlet
Operator: D. Kremer

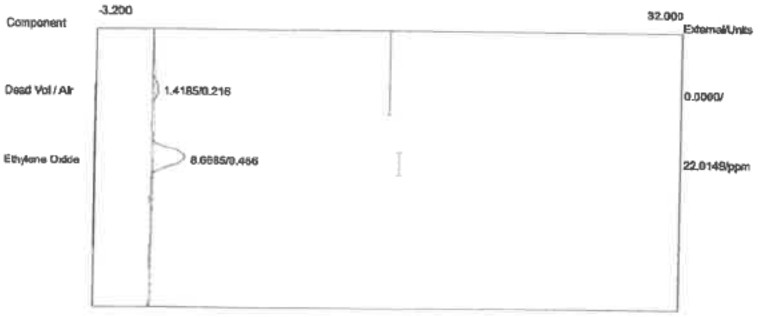
Component	Retention	Area	External	Units
Dead Vol / Air	0.233	2.4175	0.0000	
Ethylene Oxide	0.483	19.6690	49.9522	ppm
		22.0865	49.9522	

Lab name: ECSi
Client: Sterigenics - Willowbrook 2
Client ID: Run#2BV
Analysis date: 09/20/2018 16:19:13
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2Ster2WB2018-2B03.CHR (c:\peak359)
Sample: AAT Outlet
Operator: D. Kremer



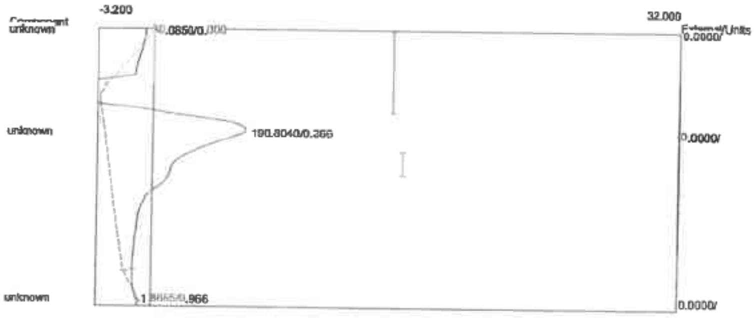
Component	Retention	Area	External	Units
		0.0000	0.0000	

Lab name: ECSi
Client: Sterigenics - Willowbrook 2
Client ID: Run#2BV
Analysis date: 09/20/2018 16:20:20
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1Ster2WB2018-2B04.CHR (c:\peak359)
Sample: AAT Inlet
Operator: D. Kremer



Component	Retention	Area	External	Units
Dead Vol / Air	0.216	1.4185	0.0000	
Ethylene Oxide	0.466	8.6685	22.0149	ppm
		10.0870	22.0149	

Lab name: ECSi
Client: Sterigenics - Willowbrook 2
Client ID: Run#2BV
Analysis date: 09/20/2018 16:20:20
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2Ster2WB2018-2B04.CHR (c:\peak359)
Sample: AAT Outlet
Operator: D. Kremer

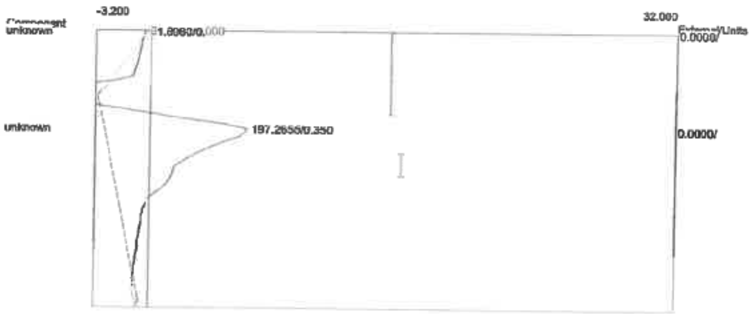


Component	Retention	Area	External	Units
		0.0000	0.0000	

Lab name: ECSi
Client: Sterigenics - Willowbrook 2
Client ID: Run#2BV
Analysis date: 09/20/2018 16:21:26
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1Ster2WB2018-2B05.CHR (c:\peak359)
Sample: AAT Inlet
Operator: D. Kremer

Component	Retention	Area	External	Units
Dead Vol / Air	0.233	3.0190	0.0000	
Ethylene Oxide	0.466	8.9850	22.8187	ppm
		12.0040	22.8187	

Lab name: ECSi
Client: Sterigenics - Willowbrook 2
Client ID: Run#2BV
Analysis date: 09/20/2018 16:21:26
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2Ster2WB2018-2B05.CHR (c:\peak359)
Sample: AAT Outlet
Operator: D. Kremer



Component	Retention	Area	External	Units
		0.0000	0.0000	

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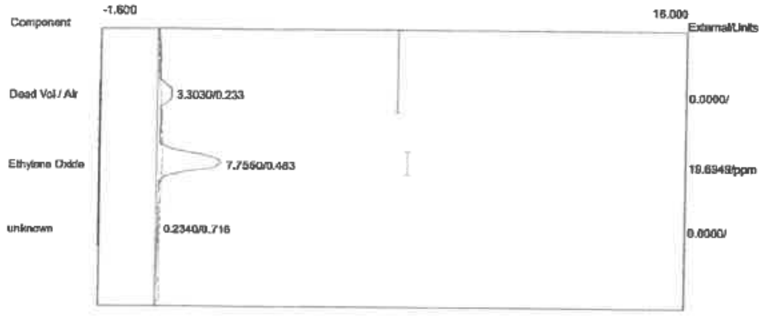
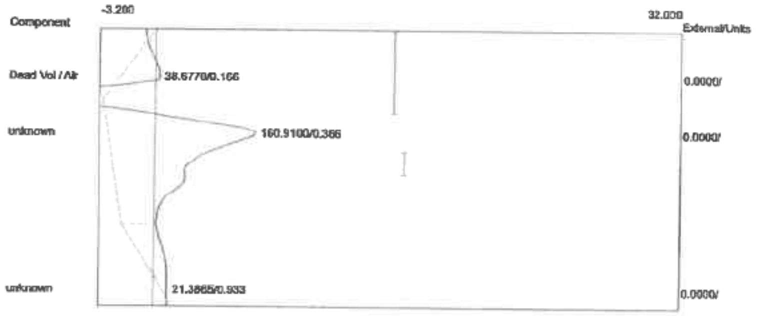
Lab name: ECSi
Client: Sterigenics - Willowbrook 2
Client ID: Run#2BV
Analysis date: 09/20/2018 16:22:48
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1Ster2WB2018-2B06.CHR (c:\peak359)
Sample: AAT Inlet
Operator: D. Kremer



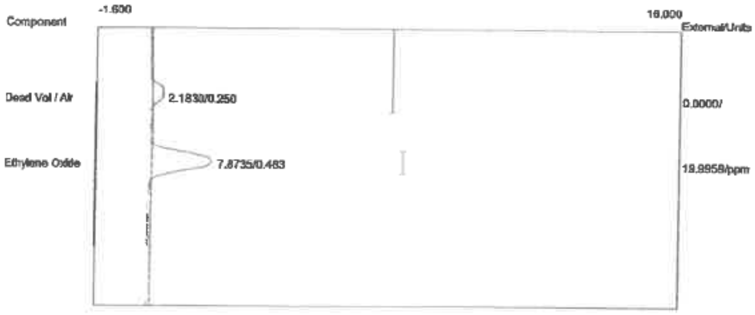
Component	Retention	Area	External	Units
Dead Vol / Air	0.233	3.3030	0.0000	
Ethylene Oxide	0.483	7.7550	19.6949	ppm
		11.0580	19.6949	

Lab name: ECSi
Client: Sterigenics - Willowbrook 2
Client ID: Run#2BV
Analysis date: 09/20/2018 16:22:48
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2Ster2WB2018-2B06.CHR (c:\peak359)
Sample: AAT Outlet
Operator: D. Kremer



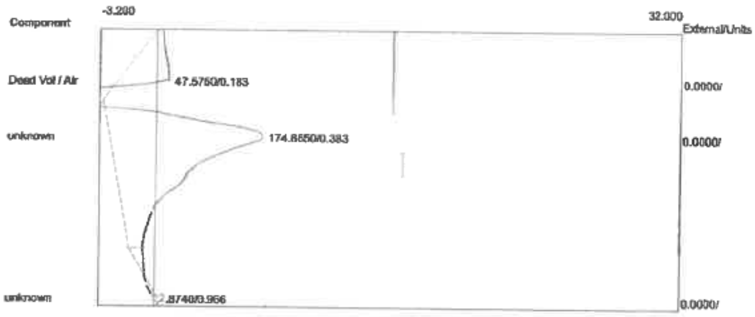
Component	Retention	Area	External	Units
Dead Vol / Air	0.166	38.6770	0.0000	
		38.6770	0.0000	

Lab name: ECSi
Client: Sterigenics - Willowbrook 2
Client ID: Run#2BV
Analysis date: 09/20/2018 16:23:56
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1Ster2WB2018-2B07.CHR (c:\peak359)
Sample: AAT Inlet
Operator: D. Kremer



Component	Retention	Area	External	Units
Dead Vol / Air	0.250	2.1830	0.0000	
Ethylene Oxide	0.483	7.8735	19.9959	ppm
		10.0565	19.9959	

Lab name: ECSi
Client: Sterigenics - Willowbrook 2
Client ID: Run#2BV
Analysis date: 09/20/2018 16:23:56
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2Ster2WB2018-2B07.CHR (c:\peak359)
Sample: AAT Outlet
Operator: D. Kremer

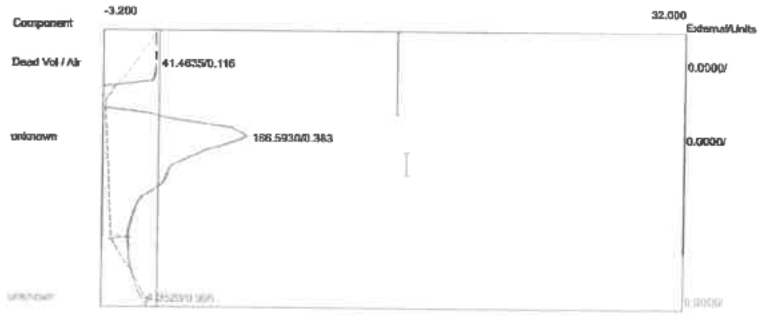


Component	Retention	Area	External	Units
Dead Vol / Air	0.183	47.5750	0.0000	
		47.5750	0.0000	

Lab name: ECSi
Client: Sterigenics - Willowbrook 2
Client ID: Run#2BV
Analysis date: 09/20/2018 16:25:05
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1Ster2WB2018-2B08.CHR (c:\peak359)
Sample: AAT Inlet
Operator: D. Kremer

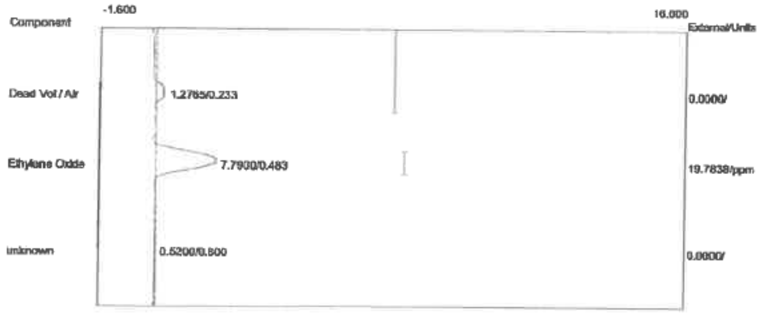
Component	Retention	Area	External	Units
Dead Vol / Air	0.233	2.2020	0.0000	
Ethylene Oxide	0.483	8.0620	20.4746	ppm
		10.2640	20.4746	

Lab name: ECSi
Client: Sterigenics - Willowbrook 2
Client ID: Run#2BV
Analysis date: 09/20/2018 16:25:05
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2Ster2WB2018-2B08.CHR (c:\peak359)
Sample: AAT Outlet
Operator: D. Kremer



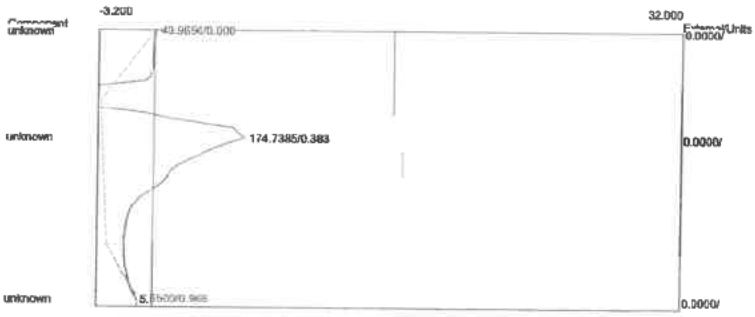
Component	Retention	Area	External	Units
Dead Vol / Air	0.116	41.4635	0.0000	
		41.4635	0.0000	

Lab name: ECSi
Client: Sterigenics - Willowbrook 2
Client ID: Run#2BV
Analysis date: 09/20/2018 16:26:10
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1Ster2WB2018-2B09.CHR (c:\peak359)
Sample: AAT Inlet
Operator: D. Kremer



Component	Retention	Area	External	Units
Dead Vol / Air	0.233	1.2765	0.0000	
Ethylene Oxide	0.483	7.7900	19.7838	ppm
		9.0665	19.7838	

Lab name: ECSi
Client: Sterigenics - Willowbrook 2
Client ID: Run#2BV
Analysis date: 09/20/2018 16:26:10
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2Ster2WB2018-2B09.CHR (c:\peak359)
Sample: AAT Outlet
Operator: D. Kremer

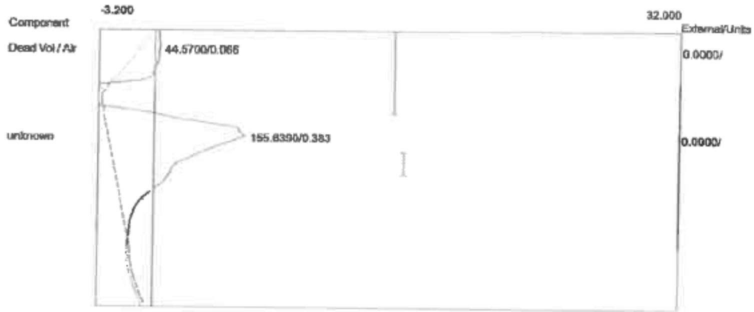


Component	Retention	Area	External	Units
		0.0000	0.0000	

Lab name: ECSi
Client: Sterigenics - Willowbrook 2
Client ID: Run#2BV
Analysis date: 09/20/2018 16:27:17
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1Ster2WB2018-2B10.CHR (c:\peak359)
Sample: AAT Inlet
Operator: D. Kremer

Component	Retention	Area	External	Units
Dead Vol / Air	0.233	2.1500	0.0000	
Ethylene Oxide	0.466	7.6645	19.4651	ppm
		9.8145	19.4651	

Lab name: ECSi
Client: Sterigenics - Willowbrook 2
Client ID: Run#2BV
Analysis date: 09/20/2018 16:27:17
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2Ster2WB2018-2B10.CHR (c:\peak359)
Sample: AAT Outlet
Operator: D. Kremer

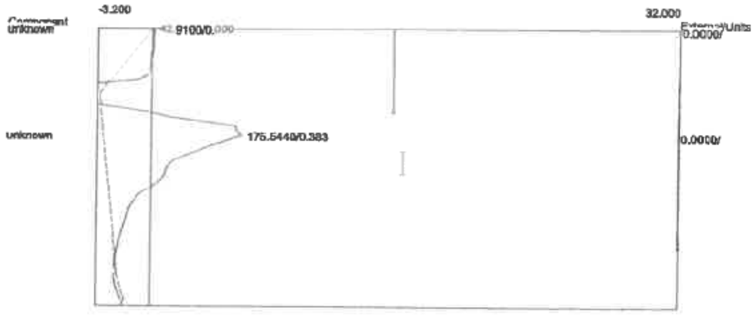


Component	Retention	Area	External	Units
Dead Vol / Air	0.066	44.5700	0.0000	
		44.5700	0.0000	

Lab name: ECSi
Client: Sterigenics - Willowbrook 2
Client ID: Run#2BV
Analysis date: 09/20/2018 16:28:25
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1Ster2WB2018-2B11.CHR (c:\peak359)
Sample: AAT Inlet
Operator: D. Kremer

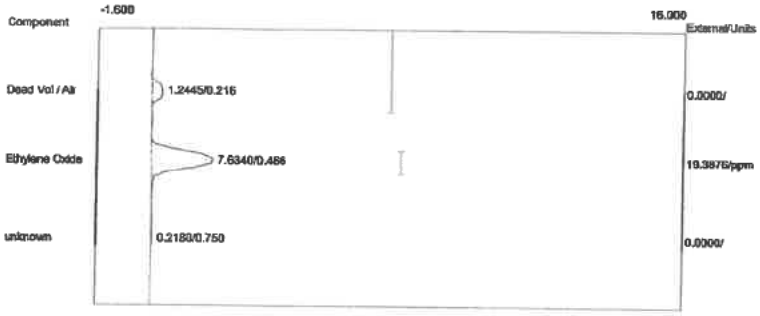
Component	Retention	Area	External	Units
Dead Vol / Air	0.216	1.5170	0.0000	
Ethylene Oxide	0.466	8.3910	21.3101	ppm
		9.9080	21.3101	

Lab name: ECSi
Client: Sterigenics - Willowbrook 2
Client ID: Run#2BV
Analysis date: 09/20/2018 16:28:25
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2Ster2WB2018-2B11.CHR (c:\peak359)
Sample: AAT Outlet
Operator: D. Kremer



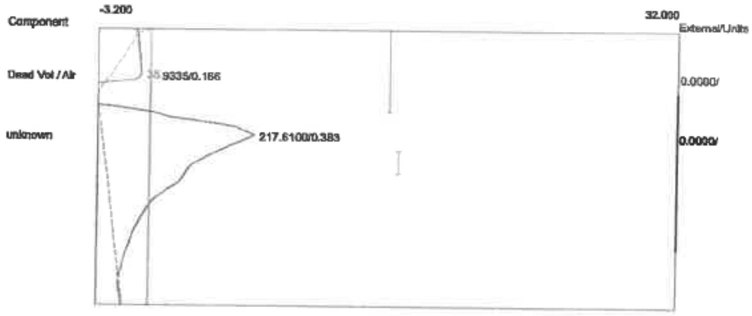
Component	Retention	Area	External	Units
		0.0000	0.0000	

Lab name: ECSi
Client: Sterigenics - Willowbrook 2
Client ID: Run#2BV
Analysis date: 09/20/2018 16:29:31
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1Ster2WB2018-2B12.CHR (c:\peak359)
Sample: AAT Inlet
Operator: D. Kremer



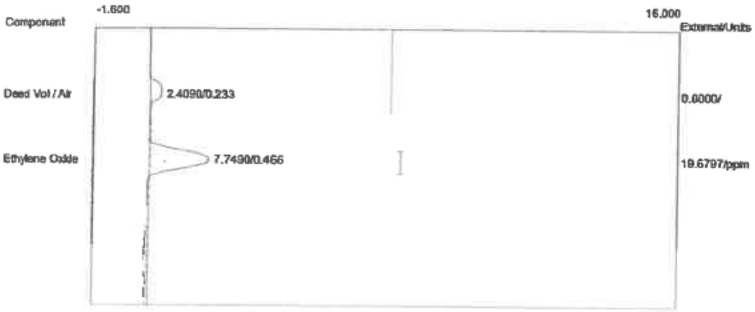
Component	Retention	Area	External	Units
Dead Vol / Air	0.216	1.2445	0.0000	
Ethylene Oxide	0.466	7.6340	19.3876	ppm
		8.8785	19.3876	

Lab name: ECSi
Client: Sterigenics - Willowbrook 2
Client ID: Run#2BV
Analysis date: 09/20/2018 16:29:31
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2Ster2WB2018-2B12.CHR (c:\peak359)
Sample: AAT Outlet
Operator: D. Kremer



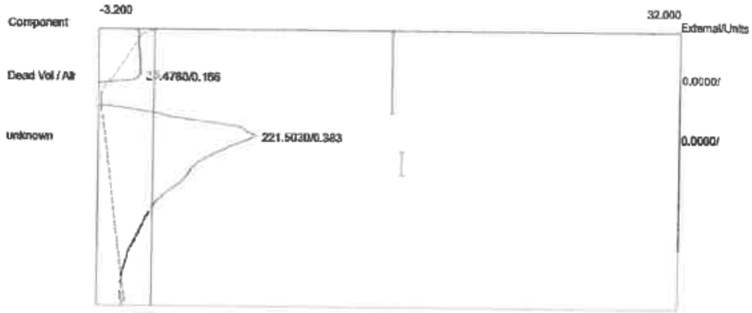
Component	Retention	Area	External	Units
Dead Vol / Air	0.166	35.9335	0.0000	
		35.9335	0.0000	

Lab name: ECSi
Client: Sterigenics - Willowbrook 2
Client ID: Run#2BV
Analysis date: 09/20/2018 16:30:38
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1Ster2WB2018-2B13.CHR (c:\peak359)
Sample: AAT Inlet
Operator: D. Kremer



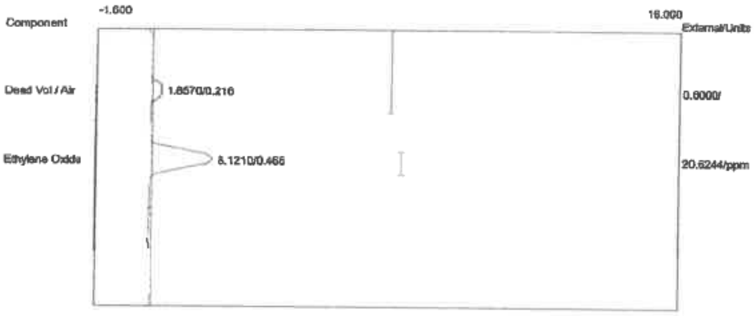
Component	Retention	Area	External	Units
Dead Vol / Air	0.233	2.4090	0.0000	
Ethylene Oxide	0.466	7.7490	19.6797	ppm
		10.1580	19.6797	

Lab name: ECSi
Client: Sterigenics - Willowbrook 2
Client ID: Run#2BV
Analysis date: 09/20/2018 16:30:38
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2Ster2WB2018-2B13.CHR (c:\peak359)
Sample: AAT Outlet
Operator: D. Kremer



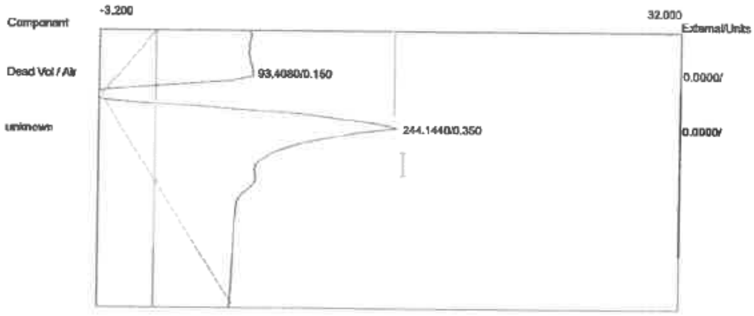
Component	Retention	Area	External	Units
Dead Vol / Air	0.166	35.4780	0.0000	
		35.4780	0.0000	

Lab name: ECSi
Client: Sterigenics - Willowbrook 2
Client ID: Run#3BV
Analysis date: 09/20/2018 16:51:01
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1Ster2WB2018-3B01.CHR (c:\peak359)
Sample: AAT Inlet
Operator: D. Kremer



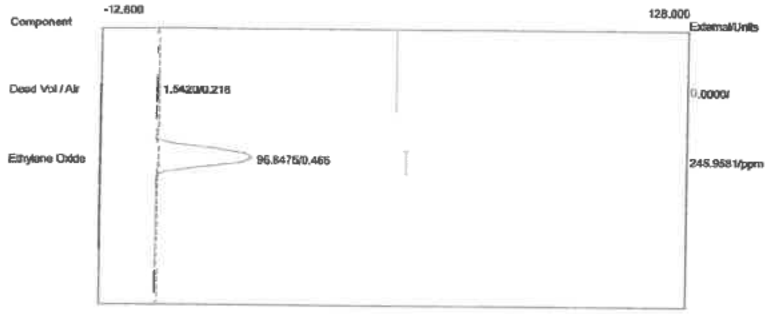
Component	Retention	Area	External	Units
Dead Vol / Air	0.216	1.8570	0.0000	
Ethylene Oxide	0.466	8.1210	20.6244	ppm
		9.9780	20.6244	

Lab name: ECSi
Client: Sterigenics - Willowbrook 2
Client ID: Run#3BV
Analysis date: 09/20/2018 16:51:01
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2Ster2WB2018-3B01.CHR (c:\peak359)
Sample: AAT Outlet
Operator: D. Kremer



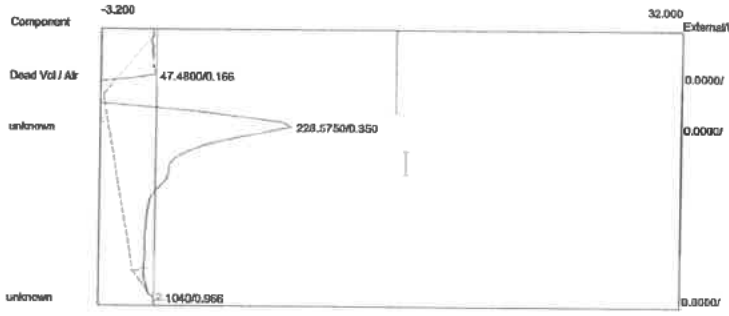
Component	Retention	Area	External	Units
Dead Vol / Air	0.150	93.4080	0.0000	
		93.4080	0.0000	

Lab name: ECSi
Client: Sterigenics - Willowbrook 2
Client ID: Run#3BV
Analysis date: 09/20/2018 16:52:10
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1Ster2WB2018-3B02.CHR (c:\peak359)
Sample: AAT Inlet
Operator: D. Kremer



Component	Retention	Area	External	Units
Dead Vol / Air	0.216	1.5420	0.0000	
Ethylene Oxide	0.466	96.8475	245.9581	ppm
		98.3895	245.9581	

Lab name: ECSi
Client: Sterigenics - Willowbrook 2
Client ID: Run#3BV
Analysis date: 09/20/2018 16:52:10
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2Ster2WB2018-3B02.CHR (c:\peak359)
Sample: AAT Outlet
Operator: D. Kremer

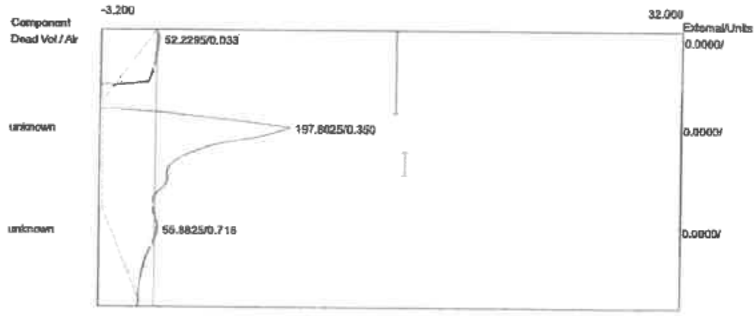


Component	Retention	Area	External	Units
Dead Vol / Air	0.166	47.4800	0.0000	
		47.4800	0.0000	

Lab name: ECSi
Client: Sterigenics - Willowbrook 2
Client ID: Run#3BV
Analysis date: 09/20/2018 16:53:38
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1Ster2WB2018-3B03.CHR (c:\peak359)
Sample: AAT Inlet
Operator: D. Kremer

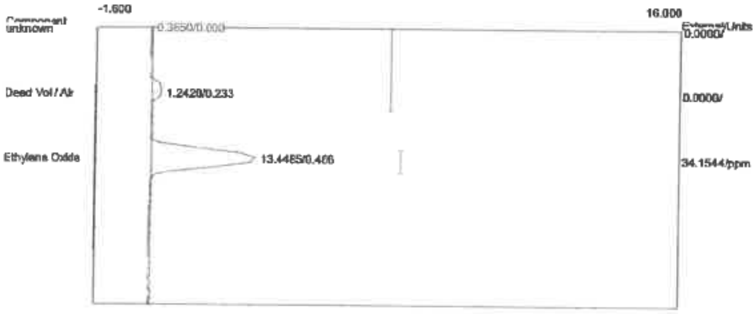
Component	Retention	Area	External	Units
Dead Vol / Air	0.233	1.3185	0.0000	
Ethylene Oxide	0.483	15.8035	40.1352	ppm
		17.1220	40.1352	

Lab name: ECSi
Client: Sterigenics - Willowbrook 2
Client ID: Run#3BV
Analysis date: 09/20/2018 16:53:38
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2Ster2WB2018-3B03.CHR (c:\peak359)
Sample: AAT Outlet
Operator: D. Kremer



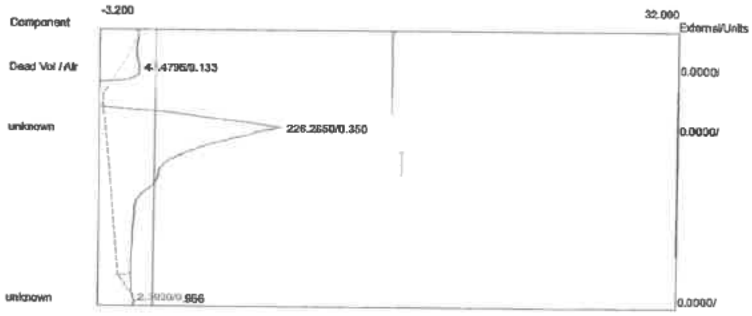
Component	Retention	Area	External	Units
Dead Vol / Air	0.033	52.2295	0.0000	
		52.2295	0.0000	

Lab name: ECSi
Client: Sterigenics - Willowbrook 2
Client ID: Run#3BV
Analysis date: 09/20/2018 16:54:45
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1Ster2WB2018-3B04.CHR (c:\peak359)
Sample: AAT Inlet
Operator: D. Kremer



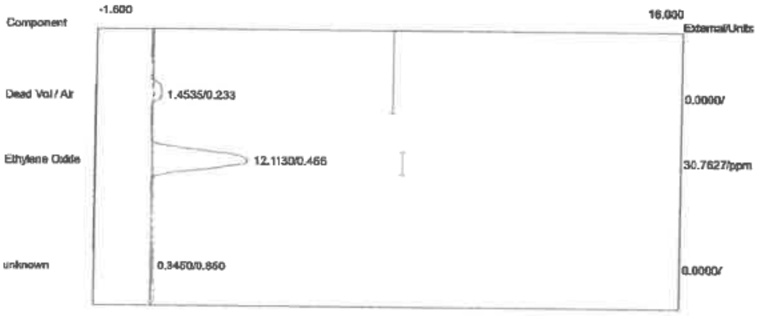
Component	Retention	Area	External	Units
Dead Vol / Air	0.233	1.2420	0.0000	
Ethylene Oxide	0.466	13.4485	34.1544	ppm
		14.6905	34.1544	

Lab name: ECSi
Client: Sterigenics - Willowbrook 2
Client ID: Run#3BV
Analysis date: 09/20/2018 16:54:45
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2Ster2WB2018-3B04.CHR (c:\peak359)
Sample: AAT Outlet
Operator: D. Kremer



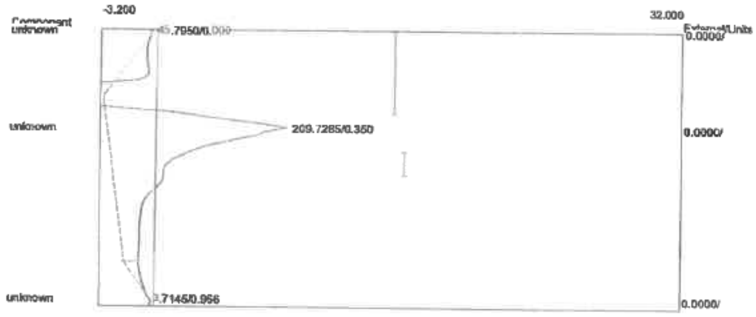
Component	Retention	Area	External	Units
Dead Vol / Air	0.133	43.4795	0.0000	
		43.4795	0.0000	

Lab name: ECSi
Client: Sterigenics - Willowbrook 2
Client ID: Run#3BV
Analysis date: 09/20/2018 16:55:55
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1Ster2WB2018-3B05.CHR (c:\peak359)
Sample: AAT Inlet
Operator: D. Kremer



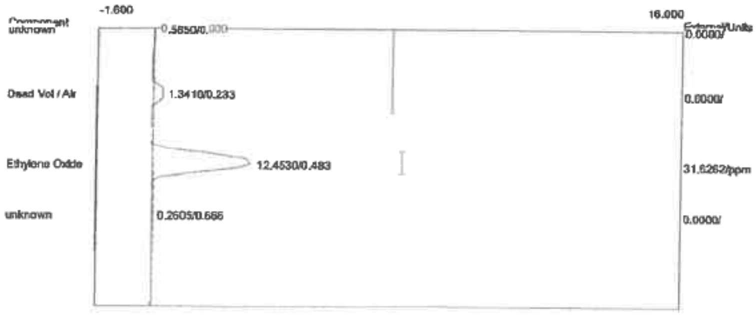
Component	Retention	Area	External	Units
Dead Vol / Air	0.233	1.4535	0.0000	
Ethylene Oxide	0.466	12.1130	30.7627	ppm
		13.5665	30.7627	

Lab name: ECSi
Client: Sterigenics - Willowbrook 2
Client ID: Run#3BV
Analysis date: 09/20/2018 16:55:55
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2Ster2WB2018-3B05.CHR (c:\peak359)
Sample: AAT Outlet
Operator: D. Kremer



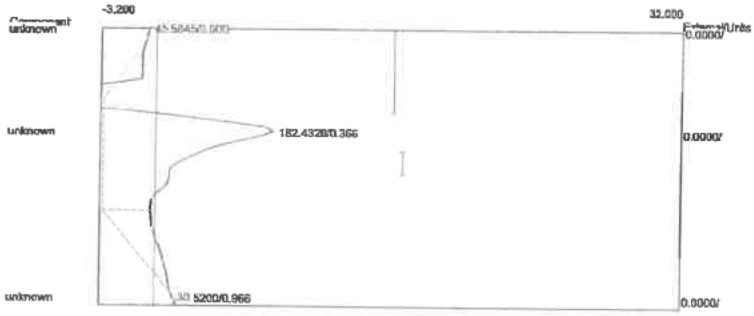
Component	Retention	Area	External	Units
		0.0000	0.0000	

Lab name: ECSi
Client: Sterigenics - Willowbrook 2
Client ID: Run#3BV
Analysis date: 09/20/2018 16:57:02
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1Ster2WB2018-3B06.CHR (c:\peak359)
Sample: AAT Inlet
Operator: D. Kremer



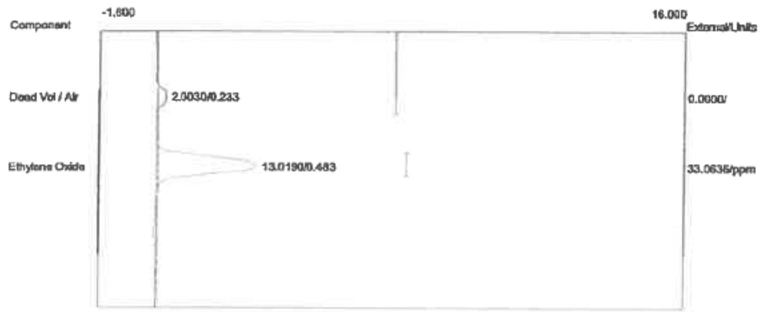
Component	Retention	Area	External	Units
Dead Vol / Air	0.233	1.3410	0.0000	
Ethylene Oxide	0.483	12.4530	31.6262	ppm
		13.7940	31.6262	

Lab name: ECSi
Client: Sterigenics - Willowbrook 2
Client ID: Run#3BV
Analysis date: 09/20/2018 16:57:02
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2Ster2WB2018-3B06.CHR (c:\peak359)
Sample: AAT Outlet
Operator: D. Kremer



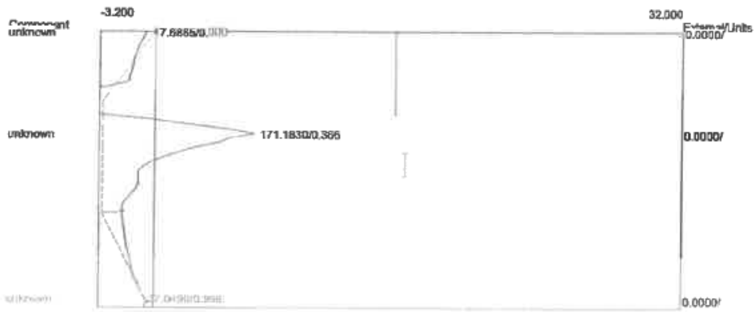
Component	Retention	Area	External	Units
		0.0000	0.0000	

Lab name: ECSi
Client: Sterigenics - Willowbrook 2
Client ID: Run#3BV
Analysis date: 09/20/2018 16:58:12
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1Ster2WB2018-3B07.CHR (c:\peak359)
Sample: AAT Inlet
Operator: D. Kremer



Component	Retention	Area	External	Units
Dead Vol / Air	0.233	2.0030	0.0000	
Ethylene Oxide	0.483	13.0190	33.0636	ppm
		15.0220	33.0636	

Lab name: ECSi
Client: Sterigenics - Willowbrook 2
Client ID: Run#3BV
Analysis date: 09/20/2018 16:58:12
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2Ster2WB2018-3B07.CHR (c:\peak359)
Sample: AAT Outlet
Operator: D. Kremer



Component	Retention	Area	External	Units
		0.0000	0.0000	

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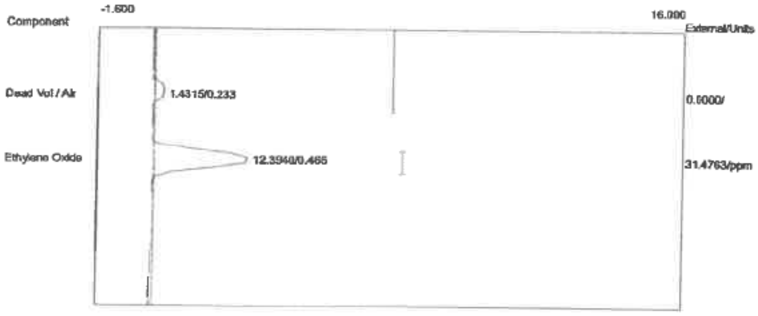
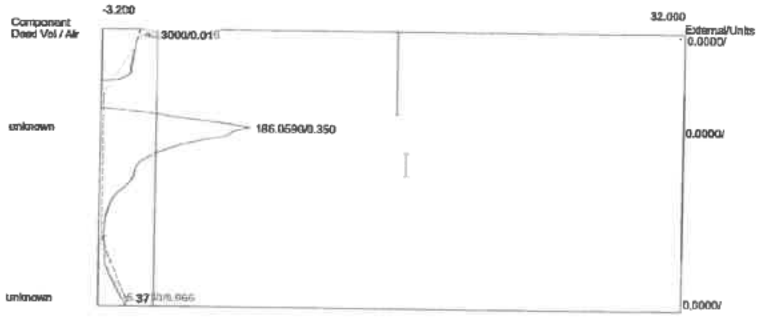
Lab name: ECSi
Client: Sterigenics - Willowbrook 2
Client ID: Run#3BV
Analysis date: 09/20/2018 16:59:22
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1Ster2WB2018-3B08.CHR (c:\peak359)
Sample: AAT Inlet
Operator: D. Kremer



Component	Retention	Area	External	Units
Dead Vol / Air	0.233	1.4315	0.0000	
Ethylene Oxide	0.466	12.3940	31.4763	ppm
		13.8255	31.4763	

Lab name: ECSi
Client: Sterigenics - Willowbrook 2
Client ID: Run#3BV
Analysis date: 09/20/2018 16:59:22
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2Ster2WB2018-3B08.CHR (c:\peak359)
Sample: AAT Outlet
Operator: D. Kremer



Component	Retention	Area	External	Units
Dead Vol / Air	0.016	43.3000	0.0000	
		43.3000	0.0000	

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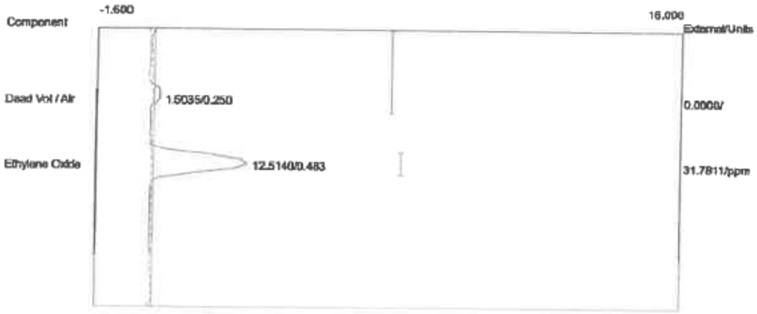
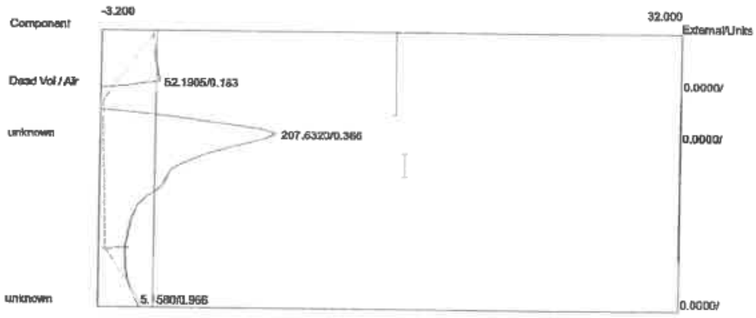
Lab name: ECSi
Client: Sterigenics - Willowbrook 2
Client ID: Run#3BV
Analysis date: 09/20/2018 17:00:31
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1Ster2WB2018-3B09.CHR (c:\peak359)
Sample: AAT Inlet
Operator: D. Kremer



Component	Retention	Area	External	Units
Dead Vol / Air	0.250	1.5035	0.0000	
Ethylene Oxide	0.483	12.5140	31.7811	ppm
		14.0175	31.7811	

Lab name: ECSi
Client: Sterigenics - Willowbrook 2
Client ID: Run#3BV
Analysis date: 09/20/2018 17:00:31
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2Ster2WB2018-3B09.CHR (c:\peak359)
Sample: AAT Outlet
Operator: D. Kremer

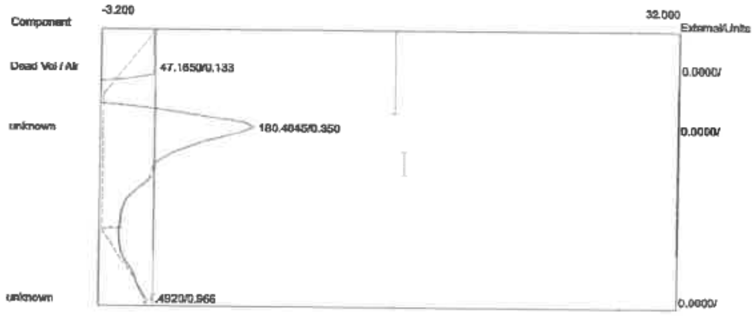


Component	Retention	Area	External	Units
Dead Vol / Air	0.183	52.1905	0.0000	
		52.1905	0.0000	

Lab name: ECSi
Client: Sterigenics - Willowbrook 2
Client ID: Run#3BV
Analysis date: 09/20/2018 17:01:45
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1Ster2WB2018-3B10.CHR (c:\peak359)
Sample: AAT Inlet
Operator: D. Kremer

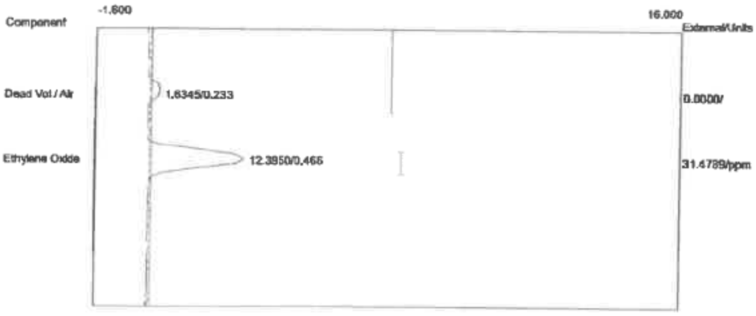
Component	Retention	Area	External	Units
Dead Vol / Air	0.216	1.4930	0.0000	
Ethylene Oxide	0.466	11.5950	29.4472	ppm
		13.0880	29.4472	

Lab name: ECSi
Client: Sterigenics - Willowbrook 2
Client ID: Run#3BV
Analysis date: 09/20/2018 17:01:45
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2Ster2WB2018-3B10.CHR (c:\peak359)
Sample: AAT Outlet
Operator: D. Kremer



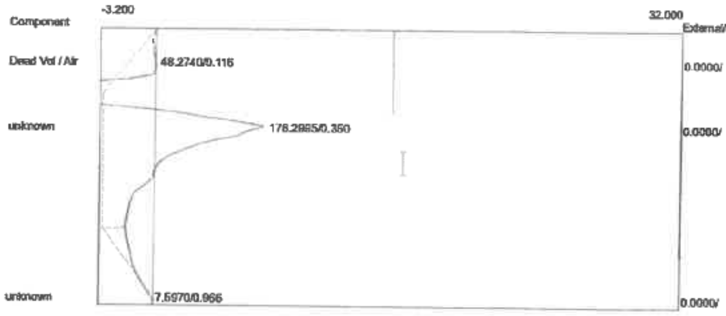
Component	Retention	Area	External	Units
Dead Vol / Air	0.133	47.1650	0.0000	
		47.1650	0.0000	

Lab name: ECSi
Client: Sterigenics - Willowbrook 2
Client ID: Run#3BV
Analysis date: 09/20/2018 17:02:56
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1Ster2WB2018-3B11.CHR (c:\peak359)
Sample: AAT Inlet
Operator: D. Kremer



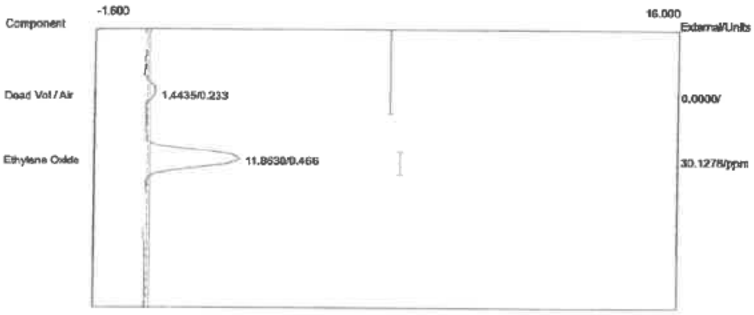
Component	Retention	Area	External	Units
Dead Vol / Air	0.233	1.6345	0.0000	
Ethylene Oxide	0.466	12.3950	31.4789	ppm
		14.0295	31.4789	

Lab name: ECSi
Client: Sterigenics - Willowbrook 2
Client ID: Run#3BV
Analysis date: 09/20/2018 17:02:56
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2Ster2WB2018-3B11.CHR (c:\peak359)
Sample: AAT Outlet
Operator: D. Kremer



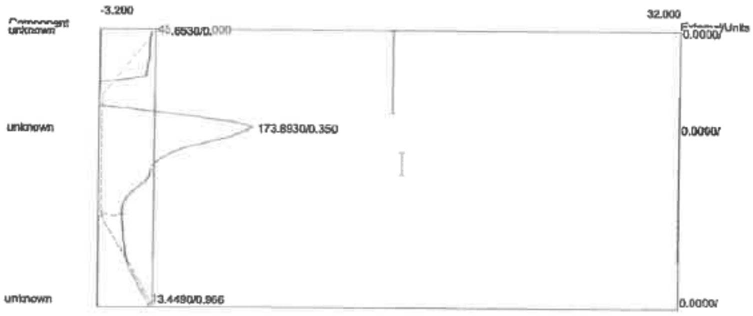
Component	Retention	Area	External	Units
Dead Vol / Air	0.116	48.2740	0.0000	
		48.2740	0.0000	

Lab name: ECSi
Client: Sterigenics - Willowbrook 2
Client ID: Run#3BV
Analysis date: 09/20/2018 17:04:06
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1Ster2WB2018-3B12.CHR (c:\peak359)
Sample: AAT Inlet
Operator: D. Kremer



Component	Retention	Area	External	Units
Dead Vol / Air	0.233	1.4435	0.0000	
Ethylene Oxide	0.466	11.8630	30.1278	ppm
		13.3065	30.1278	

Lab name: ECSi
Client: Sterigenics - Willowbrook 2
Client ID: Run#3BV
Analysis date: 09/20/2018 17:04:06
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2Ster2WB2018-3B12.CHR (c:\peak359)
Sample: AAT Outlet
Operator: D. Kremer



Component	Retention	Area	External	Units
		0.0000	0.0000	

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APPENDIX F

Field Data

(/)

Search Locations

Log in (/lo...

Recent Cities

★ (/member/favorites) Chicago Heights, IL Weather (/weather/us/il/chicago-heights/41.50,-87.65)

Elev 620ft 41.79 °N, 87.75 °W

Chicago-Midway, IL

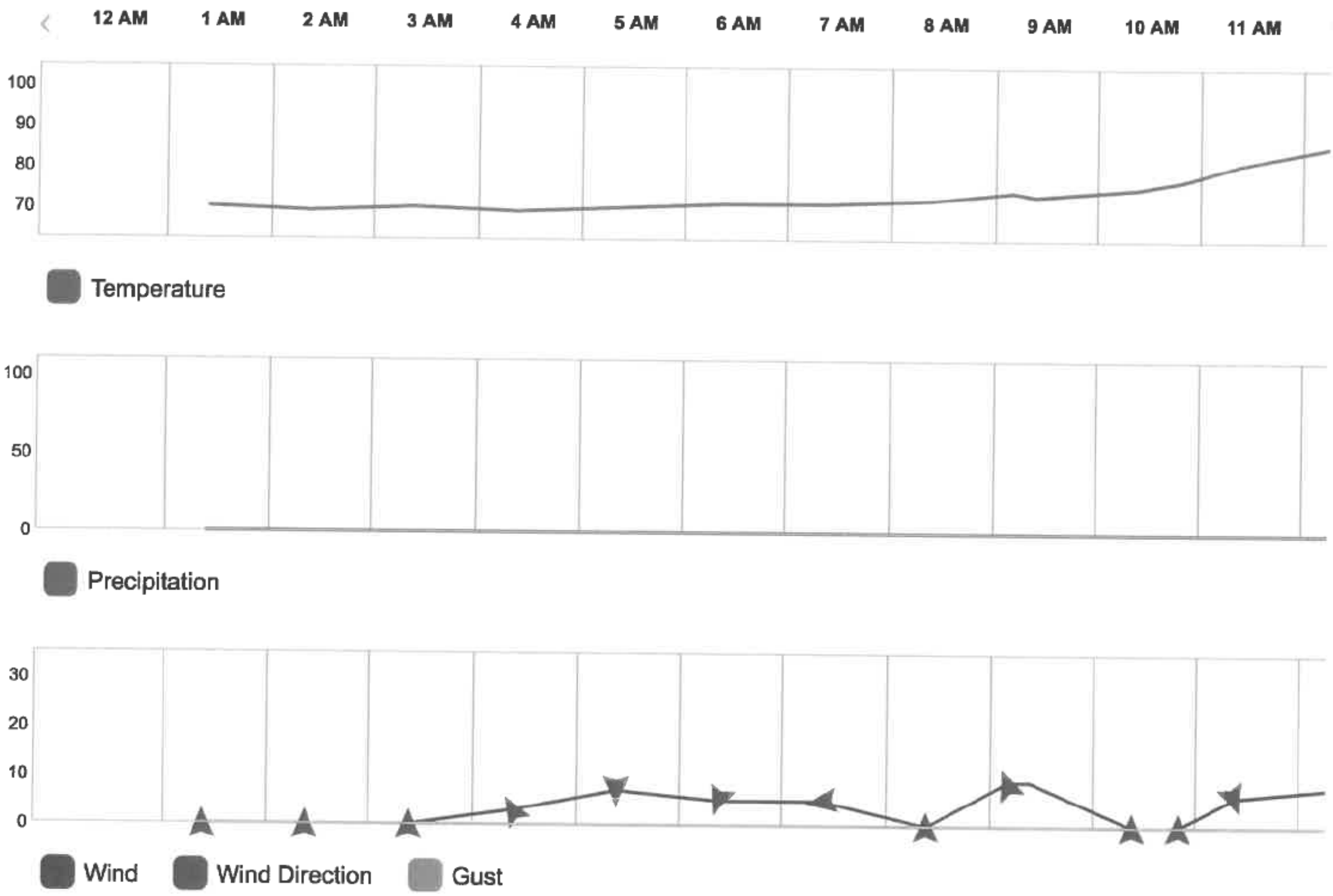
58° CHICAGO-MIDWAY STATION (/HISTORY/DAILY/US/IL/CHICAGO-MIDWAY/KMDW/DATE/2018-10-16?CM_VEN=LOCALWX_PWSDASH) | CHANGE

HISTORY (/HISTORY/DAILY/US/IL/CHICAGO-MIDWAY/KMDW/DATE/2018-10-16)

- TODAY (/WEATHER/US/IL/CHICAGO/KMDW)
- HOURLY (/HOURLY/US/IL/CHICAGO/KMDW)
- 10-DAY (/FORECAST/US/IL/CHICAGO/KMDW)
- CALENDAR (/CALENDAR/US/IL/CHICAGO-MIDWAY/KMDW/DATE/2018-10)
- HISTORY (/HISTORY/DAILY/US/IL/CHICAGO-MIDWAY/KMDW/DATE/2018-10-16)
- WUNDERMAP (/WUNDERMAP?LAT=41.78583145&LON=-87.75222015)

Daily Weekly Monthly

September 20 2018 View



Summary

Temperature (° F)	Actual	Historic Avg.	Record
High Temp	95	74	95
Low Temp	68	56	38
Day Average Temp	82	65	-
Precipitation (Inches)	Actual	Historic Avg.	Record
Precipitation	0	0.12	1.12
Month to Date	1.48	2.26	-
Year to Date	27.28	28.81	-
Degree Days (° F)	Actual	Historic Avg.	Record

Temperature (° F)	Actual	Historic Avg.	Record
Heating Degree Days	0	3	-
HDD Month to Date	0	32	-
HDD Since July 1	0	37	-
Cooling Degree Days	17	3	-
CDD Month to Date	190	100	-
CDD Year to Date	1355	1010	-
Growing Degree Days	32	-	-

Dew Point (° F)	Actual	Historic Avg.	Record
Dew Point	68	-	-
High	72	-	-
Low	65	-	-
Average	68	-	-

Wind (MPH)	Actual	Historic Avg.	Record
Max Wind Speed	22	-	-
Visibility	10	-	-

Sea Level Pressure (Hg)	Actual	Historic Avg.	Record
Sea Level Pressure	29.98	-	-

Astronomy	Day Length	Rise	Set
Actual Time	12h 16m	6:37 AM	6:53 PM
Civil Twilight		6:09 AM	7:21 PM
Nautical Twilight		5:37 AM	7:54 PM
Astronomical Twilight		5:03 AM	8:27 PM
Moon: waxing gibbous		4:54 PM	2:04 AM

Daily Observations

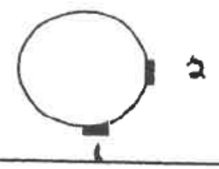
Time	Temperature	Dew Point	Humidity	Wind	Wind Speed	Wind Gust	Pressure	Precip.	Precip Accum
12:53 AM	70 ° F	66 ° F	87 %	CALM	0 mph	0 mph	29.3 in	0.0 in	0.0 in
1:53 AM	69 ° F	65 ° F	87 %	CALM	0 mph	0 mph	29.3 in	0.0 in	0.0 in
2:53 AM	70 ° F	66 ° F	87 %	CALM	0 mph	0 mph	29.3 in	0.0 in	0.0 in
3:53 AM	69 ° F	66 ° F	90 %	NNW	3 mph	0 mph	29.3 in	0.0 in	0.0 in
4:53 AM	70 ° F	66 ° F	87 %	S	7 mph	0 mph	29.3 in	0.0 in	0.0 in
5:53 AM	71 ° F	66 ° F	84 %	SSW	5 mph	0 mph	29.3 in	0.0 in	0.0 in
6:53 AM	71 ° F	67 ° F	87 %	W	5 mph	0 mph	29.3 in	0.0 in	0.0 in
7:53 AM	72 ° F	67 ° F	84 %	CALM	0 mph	0 mph	29.3 in	0.0 in	0.0 in
8:40 AM	74 ° F	68 ° F	82 %	NNW	9 mph	0 mph	29.3 in	0.0 in	0.0 in
8:53 AM	73 ° F	67 ° F	81 %	NNW	9 mph	0 mph	29.3 in	0.0 in	0.0 in
9:53 AM	75 ° F	68 ° F	79 %	CALM	0 mph	0 mph	29.3 in	0.0 in	0.0 in
10:20 AM	77 ° F	69 ° F	76 %	CALM	0 mph	0 mph	29.3 in	0.0 in	0.0 in
10:53 AM	81 ° F	70 ° F	69 %	SSE	6 mph	0 mph	29.3 in	0.0 in	0.0 in
11:53 AM	86 ° F	72 ° F	63 %	SSW	8 mph	0 mph	29.3 in	0.0 in	0.0 in
12:53 PM	89 ° F	72 ° F	57 %	SSW	12 mph	20 mph	29.3 in	0.0 in	0.0 in
1:53 PM	92 ° F	71 ° F	50 %	SW	12 mph	20 mph	29.2 in	0.0 in	0.0 in
2:53 PM	95 ° F	70 ° F	44 %	SSW	15 mph	24 mph	29.2 in	0.0 in	0.0 in
3:53 PM	94 ° F	69 ° F	44 %	SSW	18 mph	29 mph	29.2 in	0.0 in	0.0 in
4:53 PM	94 ° F	67 ° F	41 %	SW	16 mph	30 mph	29.2 in	0.0 in	0.0 in
5:53 PM	93 ° F	67 ° F	42 %	SSW	16 mph	25 mph	29.1 in	0.0 in	0.0 in
6:53 PM	92 ° F	66 ° F	42 %	SSW	13 mph	24 mph	29.1 in	0.0 in	0.0 in
7:53 PM	90 ° F	66 ° F	45 %	SSW	17 mph	28 mph	29.1 in	0.0 in	0.0 in
8:53 PM	88 ° F	67 ° F	49 %	S	15 mph	26 mph	29.1 in	0.0 in	0.0 in
9:53 PM	87 ° F	66 ° F	49 %	SSW	18 mph	30 mph	29.1 in	0.0 in	0.0 in
10:53 PM	85 ° F	67 ° F	55 %	SSW	20 mph	32 mph	29.2 in	0.0 in	0.0 in
11:53 PM	83 ° F	66 ° F	56 %	SSW	17 mph	30 mph	29.2 in	0.0 in	0.0 in

Hosted on the IBM Cloud (https://www.ibm.com/cloud/)

ECSI, INC. - VELOCITY TRAVERSE DATA

Client: Sterigenics
Location: Willowbrook - Plant 2
Source: AAT Safe Cell System Inlet

Run #: 1
Probe Type: Std.
Stack I.D.: 28 In.
Date: ~~9/8/2018~~ 9/20/18
Baro Press: ~~[illegible]~~ 29.15
DSCFM:
Port Sketch:



	Port 1							Port 2						
Inches From Port	Point#	Delta P Low	Delta P High	Delta P Average	Delta P Sq Root	Stack Temp (F)	Cyclonic Angle	Point#	Delta P Low	Delta P High	Delta P Average	Delta P Sq Root	Stack Temp (F)	Cyclonic Angle
0.5	1	0.40	0.40	#DIV/0!	#DIV/0!	88.2	7.2	1	0.50	0.50	#DIV/0!	#DIV/0!	90.4	4.7
1.9	2	0.25	0.25	#DIV/0!	#DIV/0!	88.2	6.3	2	0.25	0.25	#DIV/0!	#DIV/0!	89.9	5.4
3.3	3	0.20	0.20	#DIV/0!	#DIV/0!	88.5	3.4	3	0.30	0.30	#DIV/0!	#DIV/0!	93.3	4.8
4.9	4	0.25	0.25	#DIV/0!	#DIV/0!	91.2	4.8	4	0.35	0.35	#DIV/0!	#DIV/0!	95.4	3.6
7.0	5	0.25	0.25	#DIV/0!	#DIV/0!	93.5	3.6	5	0.40	0.40	#DIV/0!	#DIV/0!	96.7	3.2
10.0	6	0.35	0.35	#DIV/0!	#DIV/0!	95.8	4.7	6	0.45	0.45	#DIV/0!	#DIV/0!	97.4	2.1
18.0	7	0.45	0.45	#DIV/0!	#DIV/0!	95.6	3.8	7	0.45	0.45	#DIV/0!	#DIV/0!	96.7	4.8
21.0	8	0.45	0.45	#DIV/0!	#DIV/0!	96.7	3.7	8	0.47	0.47	#DIV/0!	#DIV/0!	97.6	3.9
23.1	9	0.45	0.45	#DIV/0!	#DIV/0!	97.4	5.1	9	0.40	0.45	#DIV/0!	#DIV/0!	98.0	5.1
24.7	10	0.45	0.45	#DIV/0!	#DIV/0!	97.9	4.5	10	0.45	0.45	#DIV/0!	#DIV/0!	98.4	5.4
26.1	11	0.45	0.45	#DIV/0!	#DIV/0!	98.2	3.6	11	0.48	0.48	#DIV/0!	#DIV/0!	98.4	3.8
27.5	12	0.30	0.30	#DIV/0!	#DIV/0!	97.4	2.2	12	0.35	0.35	#DIV/0!	#DIV/0!	98.3	2.0
	13							13						
	14							14						
	15							15						
	16							16						
	17							17						
	18							18						
	19							19						
	20							20						
	21							21						
	22							22						
	23							23						
	24							24						
									Average Values:		#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!

*stack static pressure measured at -0.35" H_2O

*Pitot tube P-6-4 (s-type) was leak checked @2" H_2O, max scale on the manometer

ECSI, INC. - VELOCITY TRAVERSE DATA

Client: Sterigenics
Location: Willowbrook - Plant 2
Source: AAT Safe Cell System Outlet

Run #: 1
Probe Type: Std.
Stack I.D.: 28x28 = 5.44 ft²
Date: ~~9/8/2018~~ 9/20/18
Baro Press: ~~29.35~~ 29.15
DSCFM:
Port Sketch: 1 2 3 4

Inches From Port	Port 1 & 2 Point#	Delta P Low	Delta P High	Delta P Average	Delta P Sq Root	Stack Temp (F)	Cyclonic Angle	Port 3 & 4 Point#	Delta P Low	Delta P High	Delta P Average	Delta P Sq Root	Stack Temp (F)	Cyclonic Angle
3.5	1	0.5	.5	#DIV/0!	#DIV/0!	100.5	3.9	1	0.3	0.3	#DIV/0!	#DIV/0!	99.9	4.4
7.0	2	0.55	0.55	#DIV/0!	#DIV/0!	102.2	3.9	2	0.25	0.25	#DIV/0!	#DIV/0!	101.5	5.4
10.5	3	0.6	0.6	#DIV/0!	#DIV/0!	102.2	2.6	3	0.25	0.25	#DIV/0!	#DIV/0!	102.2	5.6
14.0	4	0.6	0.6	#DIV/0!	#DIV/0!	102.2	2.6	4	0.20	0.20	#DIV/0!	#DIV/0!	102.4	3.1
17.5	5	0.55	0.55	#DIV/0!	#DIV/0!	102.1	2.5	5	0.15	0.15	#DIV/0!	#DIV/0!	102.3	1.8
21.0	6	0.6	0.6	#DIV/0!	#DIV/0!	102.1	2.1	6	0.20	0.20	#DIV/0!	#DIV/0!	102.4	2.5
24.5	7	0.6	0.6	#DIV/0!	#DIV/0!	102.1	3.8	7	0.20	0.20	#DIV/0!	#DIV/0!	102.3	2.0
3.5	1	0.4	0.4	#DIV/0!	#DIV/0!	99.4	1.1	1	0.15	0.15	#DIV/0!	#DIV/0!	101.0	4.2
7.0	2	0.4	0.4	#DIV/0!	#DIV/0!	101.4	6.2	2	0.15	0.15	#DIV/0!	#DIV/0!	101.8	5.0
10.5	3	0.4	0.4	#DIV/0!	#DIV/0!	102.2	2.0	3	0.10	0.10	#DIV/0!	#DIV/0!	101.7	1.2
14.0	4	0.3	0.3	#DIV/0!	#DIV/0!	102.3	4.4	4	0.10	0.10	#DIV/0!	#DIV/0!	102.3	4.7
17.5	5	0.3	0.3	#DIV/0!	#DIV/0!	102.2	4.7	5	0.10	0.10	#DIV/0!	#DIV/0!	102.4	1.8
21.0	6	0.4	0.4	#DIV/0!	#DIV/0!	102.3	5.1	6	0.10	0.10	#DIV/0!	#DIV/0!	102.4	0.8
24.5	7	0.4	0.4	#DIV/0!	#DIV/0!	102.3	4.6	7	0.10	0.10	#DIV/0!	#DIV/0!	102.0	2.5
									Average Values:	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	

* Stack static pressure measured at 0.1" H_2O
* Pitot tube P-4-3 (S type) was leak checked @ 2" H_2O, max scale on the manometer
* Pitot tube std-1 (std.) was leak checked @ 2" H_2O, max scale on the manometer

WB2 Run #1 9/20/18

Inj #	ΔP (inlet/outlet)	Temp (inlet/outlet)
1	.38 / .32	100 / 100
2	.38 / .32	101 / 101
3	.38 / .32	102 / 102
4	.38 / .32	101 / 101
5	.38 / .32	101 / 101
6	.38 / .32	102 / 102
7	.38 / .32	102 / 102
8	.38 / .32	102 / 102
9	.38 / .32	102 / 102
10	.38 / .32	103 / 103
11	.38 / .32	102 / 102
12	.38 / .32	103 / 103
13		
14		
15		

WB2 Run #2 9/20/18

Inj	ΔP In/out	Temp In/out
1	.38/.32	102/102
2	.38/.32	103/103
3	.38/.32	104/104
4	.38/.32	103/103
5	.38/.32	103/103
6	.38/.32	103/103
7	.38/.32	103/103
8	.38/.32	104/104
9	.38/.32	103/103
10	.38/.32	103/103
11	.38/.32	103/103
12	.38/.32	103/103
13	.38/.32	103/103
14		
15		

WB2

Run#3 9/20/18

Inj	ΔP In/out	Temp In/out
1	.38/.32	104/104
2	.38/.32	104/104
3	.38/.32	104/104
4	.38/.32	104/104
5	.38/.32	104/104
6	.38/.32	104/104
7	.38/.32	104/104
8	.38/.32	105/105
9	.38/.32	104/104
10	.38/.32	104/104
11	.38/.32	104/104
12	.38/.32	104/104
13		
14		
15		

APPENDIX G

Testing Equipment Information

ECSi

CleanAir.

CleanAir Instrument Rental
500 W. Wood Street
Palatine, IL 60067-4975
800-553-5511
www.cleanair.com

Pitot Tube Calibration

Probe Type: S-Type Pitot

I.D. Number: P-6-4

Project Number:

Thermocouple Calibration

Reference Type: Thermometer Reference I.D. No: 1641582Rg Pyrometer I.D. No: 80512890 Units: °F

Point No.	Target Temp.	Reference Temp.	Indicated Temp.	Temp. Difference	% Difference*	Within spec?
1	Ambient					
2	200°F-250°F					

* Based on Absolute Temperature (Rankine) %Difference ≤ 1.5

Geometric Pitot Calibration

Is pitot assembly in good repair? ◉Yes ○No If no, explain:

"S" Pitot

Dimensions		Dimensions		Specifications	Within Spec?
α1=	1.0	α2=	0.0	<=10 °	YES
β1=	2.0	β2=	2.0	<=5°	YES
γ=	0.0	θ=	0.0	None	N/A
A=	0.718			None	N/A
Dt=	0.250			0.1875"<=Dt<=0.375"	YES

	Calculations	Specifications	Within Spec?
A/2=Pa=Pb=	0.359 inches	None	N/A
Pa/Dt=Pb/Dt=	1.436 inches	1.05<P/Dt<1.5	YES
z = A sin γ =	0.000 inches	<=0.125"	YES
w = A sin θ =	0.000 inches	<=0.03125"	YES

Pitot Cp= 0.84 according to 40 CFR 60 section 10.1

Standard Pitot

	Measurement	Specification	Calculation	Within Spec?
Tube O.D.		None		
Static Hole I.D.		within 10% of (0.1*O.D.)		
Tip to Static		>=6*O.D.		
Static to Bend		>=8*O.D.		

Pitot Cp=

Calibrated by: Wayne Berry Date: 4/26/2018

CleanAir

CleanAir Instrument Rental
500 W. Wood Street
Palatine, IL 60067-4975
800-553-5511
www.cleanair.com

Pitot Tube Calibration

Probe Type: S-Type Pitot

I.D. Number: P-4-2

Project Number:

Thermocouple Calibration

Reference Type: Thermometer Reference I.D. No: 1641582Rg Pyrometer I.D. No: 80512890 Units: °F

Point No.	Target Temp.	Reference Temp.	Indicated Temp.	Temp. Difference	% Difference*	Within spec?
1	Ambient					
2	200°F-250°F					

* Based on Absolute Temperature (Rankine) %Difference ≤ 1.5

Geometric Pitot Calibration

Is pitot assembly in good repair? ◉Yes ○No If no, explain:

"S" Pitot

	Dimensions		Dimensions	Specifications	Within Spec?
$\alpha1$=	1.0	$\alpha2$=	1.0	<=10 °	YES
$\beta1$=	-1.0	$\beta2$=	2.0	<=5°	YES
γ=	3.0	θ=	0.0	None	N/A
A=	0.731			None	N/A
Dt=	0.250			0.1875"<=Dt<=0.375"	YES

	Calculations	Specifications	Within Spec?
A/2=Pa=Pb=	0.366 inches	None	N/A
Pa/Dt=Pb/Dt=	1.462 inches	1.05<P/Dt<1.5	YES
z = A sin γ =	0.038 inches	<=0.125"	YES
w = A sin θ =	0.000 inches	<=0.03125"	YES

Pitot Cp= **0.84 according to 40 CFR 60 section 10.1**

Standard Pitot

	Measurement	Specification	Calculation	Within Spec?
Tube O.D.	1.000 inches	None		N/A
Static Hole I.D.		within 10% of (0.1*O.D.)		
Tip to Static		>=6*O.D.		
Static to Bend		>=8*O.D.		

Pitot Cp=

Calibrated by: Wayne Berry

Date: 9/19/2018

From:	Bill Graham <bgraham@cleanair.com>
Sent:	Wednesday, September 19, 2018 9:52 AM
To:	Ulfig, Joseph
Subject:	RE: Reference P-50998

Joe,
here is a cut sheet for heated lines directly from our Express Sales website. Sterigenics currently has one 0723-100 and one 0723-100HD.
the tubing is the same in both of them.

Regards,

Bill Graham Palatine Rental Team Leader
CleanAir Instrument Rental
500 W. Wood St. | Palatine, IL 60067
O: +1-800-553-5511 | rental.cleanair.com

HEATED SAMPLE LINES

These heated sample lines feature an electrically heat traced and insulated 3/8" Teflon ® PTFE (.030 Wall) sample line with a stainless steel over braid and stainless steel tube ends, a 1/4 Teflon ® PTFE (.040) calibration line, 5 pin Amphenol power connector, and 2 type K thermocouple plugs. Protected by a durable scuff resistant extruded polyurethane jacket. *Temperature controller sold separately. *These Heated Sample Lines are not self limiting, a temperature controller is required.

HEATED SAMPLE LINES ARE USED WITH:

- CEM Cateco - 0035RNT
- CEM 3 Point Probe - 0723123
- Temperature Controllers

HEAVY DUTY VERSUS STANDARD HEATED SAMPLE LINE

- Note: Heavy Duty Heated Sample Lines HD are manufactured to have a continuous operating temperature of 400°F (~204°C) at an ambient temperature of -20°F.
- Note: Standard Heated Sample Lines are manufactured to have a continuous operating temperature of 400°F (~204°C) at an ambient temperature of 0°F.

HEATED SAMPLE LINE FEATURES:

- Rated for 400 ° F continuous operation at -20 ° F ambient temperature
- Triple insulation maintains temperature of line with less power consumption. **(Heavy Duty)**
- Lower resistance heaters requires less power to heat lines.
- A backup type K thermocouple to prevent project delays in the case of primary thermocouple failure in the field.
- Stainless steel over braid and stainless steel tube ends for the sample line to prevent abrasive failure in the field. Optional stainless steel over braid for protection of calibration line from abrasive failure in the field.
- Durable extruded poly-urethane jacket for protection of sample/calibration lines from abrasive failure in the field.
- Inert teflon ® PTFE sample and calibration lines will provide more accurate results by eliminating potential bias from other materials. Teflon is also more corrosion resistant than tygon, and can be washed with acetone without degradation.

Part Number	Voltage	Watts	Length FT	Amp.
0723-10	120	300	10' Heated Sample Line	2.73
0723-25	120	750	25' Heated Sample Line	6.82
0723-50	120	1500	50' Heated Sample Line	13.64
0723-100	120	2500	100' Heated Sample Line	22.73
*0723-100HD	120	3000	100' Heavy Duty Heated Sample Line	27
0723-100220	120/240	N/A	100' Dual Voltage Heated Sample Line	N/A
0725RENT	Universal Temperature Controller			

Custom lengths, voltage, and configuration available***Heavy Duty Heated Sample Lines are manufactured to have a continuous operating temperature of 400°F (~204°C) at -20°F ambient temperature.**These Heated Sample Lines may be rented through CleanAir Rental

FLIR Commercial Systems, Inc.
9 Townsend West
Nashua, NH 03063 USA
Telephone: 603.324.7600
1-800-GOINFRA

Certificate of Compliance

We hereby certify that to the best of our knowledge, the instruments listed below meet or exceed the specifications stated in the appropriate instruction manuals. FLIR Commercial Systems, Inc., an ISO 9001:2008 certified company, inspects its incoming shipments using an approved sampling plan with an AQL. All incoming inspections are performed using test equipment that is traceable to National Standards.

CUSTOMER: ECSI, INC.
MODEL #: EA10
SERIAL#: 171103433

Dated this day: 04/03/2018

APPENDIX H

Sample Line Residence Time

ECSi

Sample Line Volume Calculation

Data: 100 ft of 3/8" Teflon line with wall thickness of .030"

Interior Volume Radius: (outside diameter/2) – (wall thickness) = (.375"/2) - .030" = 0.1575"

0.1575" * 1 ft/12 inches = 0.013125 feet

Cylindrical Volume = pi * r^2 * length = 3.1459 * $(0.013125)^2$ * 1 foot line length = 0.00054193 cubic feet per foot of line

0.00054193 cubic feet * 28316.8 cc / 1 cubic foot = 15.3457 cc per foot of line

For 100 foot of line, the total interior volume is 1535 cc.

Sample Residence Time Calculation

Sample Residence Time = Volume of sample lines / Sample pump flow rate

= 1535 cc / 500-1000 cc per minute = 1.54 - 3.07 minutes

APPENDIX I

Calibration Data

ETHYLENE OXIDE SOURCE TEST/CALIBRATION DATA

Client: Stericgenics - Willowbrook 2

Source Tested: AAT Safe Cell System Date: 9/20/18

PRE CALIBRATION									
	Calibration Gas Conc. (ppmv)	1.10 ppm EtO	10.1 ppm EtO	100 ppm EtO	1000 ppm EtO	10080 ppm EtO			
Inlet	Area Counts #1	.431	4.00	39.3					
(FID)	Area Counts #2/3	.437 / .432	3.98 / 3.96	39.4 / 39.3					
	Average Area	.4333	3.980	39.33			Sample Line Bias Calibration		
	Audit Standard (48.8 ppmv) Result						102.2 ppm (Std @ 100 ppmv)		
	Calibration Gas Conc. (ppmv)	1.10 ppm EtO	10.1 ppm EtO	100 ppm EtO					
Outlet	Area Counts #1	2.77	25.1	249					
(PID)	Area Counts #2/3	2.77 / 2.76	25.6 / 25.7	250 / 249					
	Average Area	2.767	25.47	249.3			Sample Line Bias Calibration		
	Audit Standard (48.8 ppmv) Result						101.5 ppm (Std @ 100 ppmv)		

	Run #1	Run #2	Run #3
BV Start :	1538	1616	1650
BV Stop :	1553	1631	1705

P_{bar}: 29.15

%H_2O: ______

EtO Usage (lbs/yr): ______

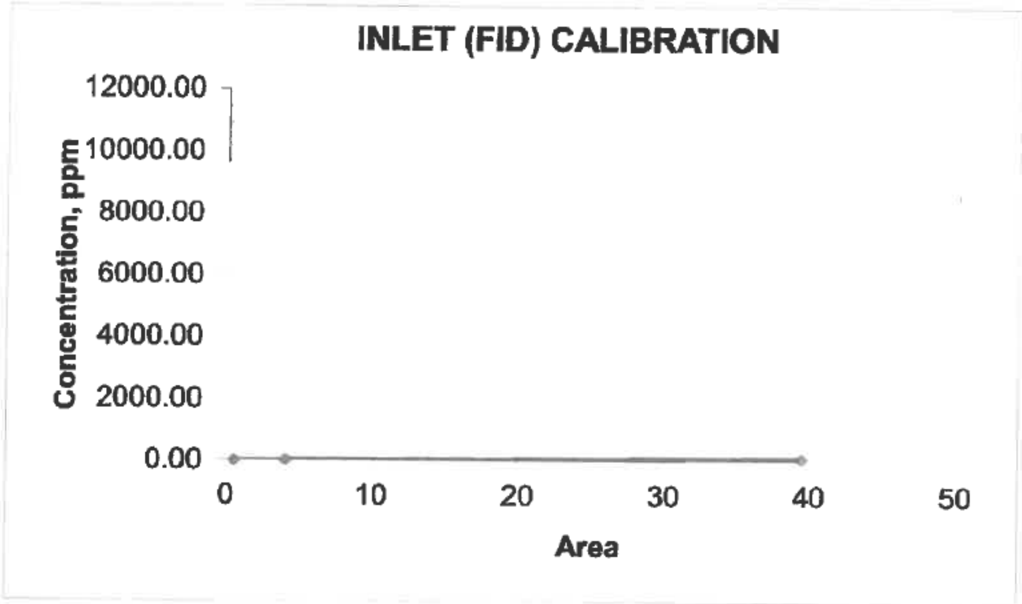
Cycles Per Week: ______

MID/POST CALIBRATION									
	Calibration Gas Conc. (ppmv)	1.10 ppm EtO	10.1 ppm EtO	100 ppm EtO	1000 ppm EtO	10080 ppm EtO			
Inlet	~~Mid Cal~~	Post Cal Sample Line Bias							
(FID)	Post Cal			39.7 = 100.9 ppm					
	Audit Standard (48.8 ppmv) Result								
	Calibration Gas Conc. (ppmv)	1.10 ppm EtO	10.1 ppm EtO	100 ppm EtO					
Outlet	~~Mid Cal~~	Post Cal Sample Line Bias							
(PID)	Post Cal		25.6 = 10.20 ppm						
	Audit Standard (48.8 ppmv) Result								

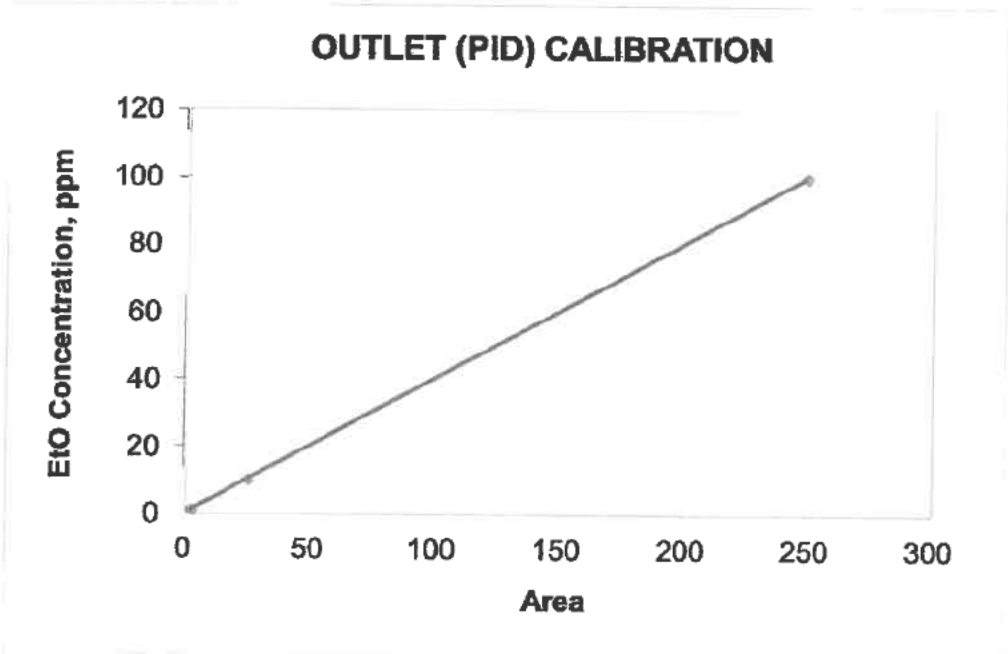
ECSi

EtO Calibrations

Site: Sterigenics - Willowbrook 2
Date: 9/20/2018



Slope 2.54
Intercept -0.01

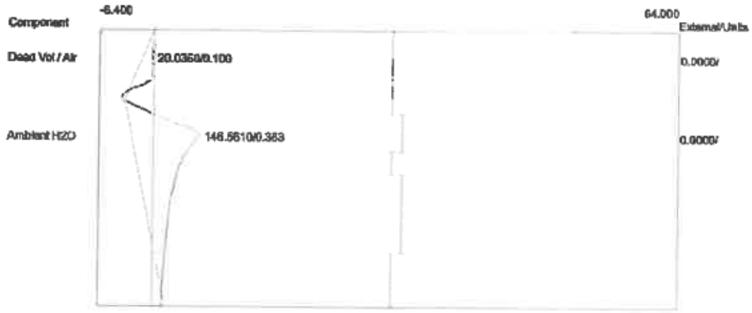


Slope 0.401
Intercept -0.0399

Lab name: ECSI
Client: Sterigenics - Willowbrook 2
Client ID: PreCal
Analysis date: 09/20/2018 09:34:38
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1Ster2WB2018-Amb.CHR (c:\peak359)
Sample: Ambient Background
Operator: D. Kremer

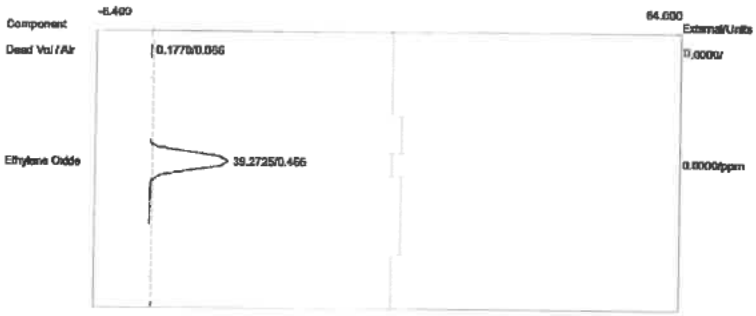
Component	Retention	Area	External	Units
Dead Vol / Air	0.216	2.0040	0.0000	
Acetaldehyde	0.716	0.2015	0.0000	
		2.2055	0.0000	

Lab name: ECSI
Client: Sterigenics - Willowbrook 2
Client ID: PreCal
Analysis date: 09/20/2018 09:34:38
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2Ster2WB2018-Amb.CHR (c:\peak359)
Sample: Ambient Background
Operator: D. Kremer



Component	Retention	Area	External	Units
Dead Vol / Air	0.100	20.0360	0.0000	
Ambient H2O	0.383	146.5610	0.0000	
		166.5970	0.0000	

Lab name: ECSi
Client: Sterigenics - Willowbrook 2
Client ID: PreCal
Analysis date: 09/20/2018 09:50:51
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1Ster2WB2018-C01.CHR (c:\peak359)
Sample: 100 ppm std
Operator: D. Kremer



Component	Retention	Area	External	Units
Dead Vol / Air	0.066	0.1770	0.0000	
Ethylene Oxide	0.466	39.2725	0.0000	ppm
		39.4495	0.0000	

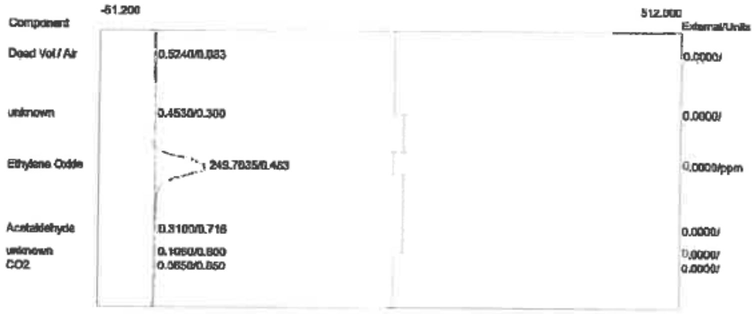
Lab name: ECSi
Client: Sterigenics - Willowbrook 2
Client ID: PreCal
Analysis date: 09/20/2018 09:50:51
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2Ster2WB2018-C01.CHR (c:\peak359)
Sample: 100 ppm std
Operator: D. Kremer

Component	Retention	Area	External	Units
Dead Vol / Air	0.083	0.4000	0.0000	
Ethylene Oxide	0.500	249.4900	0.0000	ppm
Acetaldehyde	0.750	0.1390	0.0000	
CO2	0.883	0.1910	0.0000	
		250.2200	0.0000	

Lab name: ECSi
Client: Sterigenics - Willowbrook 2
Client ID: PreCal
Analysis date: 09/20/2018 09:54:38
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1Ster2WB2018-C02.CHR (c:\peak359)
Sample: 100 ppm std
Operator: D. Kremer

Component	Retention	Area	External	Units
Dead Vol / Air	0.050	0.1345	0.0000	
Ethylene Oxide	0.466	39.4295	0.0000	ppm
Acetaldehyde	0.566	0.1735	0.0000	
		39.7375	0.0000	

Lab name: ECSI
Client: Sterigenics - Willowbrook 2
Client ID: PreCal
Analysis date: 09/20/2018 09:54:38
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2Ster2WB2018-C02.CHR (c:\peak359)
Sample: 100 ppm std
Operator: D. Kremer

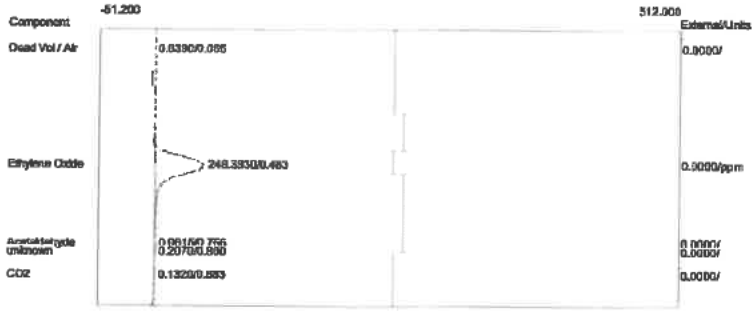


Component	Retention	Area	External	Units
Dead Vol / Air	0.083	0.5240	0.0000	
Ethylene Oxide	0.483	249.7035	0.0000	ppm
Acetaldehyde	0.716	0.3100	0.0000	
CO2	0.850	0.0650	0.0000	
		250.6025	0.0000	

Lab name: ECSI
Client: Sterigenics - Willowbrook 2
Client ID: PreCal
Analysis date: 09/20/2018 09:58:20
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1Ster2WB2018-C03.CHR (c:\peak359)
Sample: 100 ppm std
Operator: D. Kremer

Component	Retention	Area	External	Units
Dead Vol / Air	0.216	0.1240	0.0000	
Ethylene Oxide	0.466	39.2880	0.0000	ppm
		39.4120	0.0000	

Lab name: ECSI
Client: Sterigenics - Willowbrook 2
Client ID: PreCal
Analysis date: 09/20/2018 09:58:20
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2Ster2WB2018-C03.CHR (c:\peak359)
Sample: 100 ppm std
Operator: D. Kremer



Component	Retention	Area	External	Units
Dead Vol / Air	0.066	0.8390	0.0000	
Ethylene Oxide	0.483	249.3930	0.0000	ppm
Acetaldehyde	0.766	0.0615	0.0000	
CO2	0.883	0.1320	0.0000	
		250.4255	0.0000	

Lab name: ECSi
Client: Sterigenics - Willowbrook 2
Client ID: PreCal
Analysis date: 09/20/2018 10:14:50
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1Ster2WB2018-C04.CHR (c:\peak359)
Sample: 10.1 ppm std
Operator: D. Kremer

Component	Retention	Area	External	Units
Ethylene Oxide	0.466	3.9950	0.0000	ppm
		3.9950	0.0000	

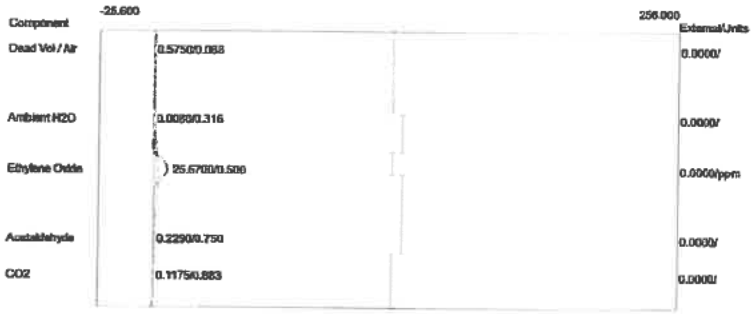
Lab name: ECSi
Client: Sterigenics - Willowbrook 2
Client ID: PreCal
Analysis date: 09/20/2018 10:14:50
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2Ster2WB2018-C04.CHR (c:\peak359)
Sample: 10.1 ppm std
Operator: D. Kremer

Component	Retention	Area	External	Units
Dead Vol / Air	0.100	0.9400	0.0000	
Ethylene Oxide	0.500	25.1190	0.0000	ppm
Acetaldehyde	0.550	0.4035	0.0000	
CO2	0.816	0.1930	0.0000	
		26.6555	0.0000	

Lab name: ECSi
Client: Sterigenics - Willowbrook 2
Client ID: PreCal
Analysis date: 09/20/2018 10:19:14
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1Ster2WB2018-C05.CHR (c:\peak359)
Sample: 10.1 ppm std
Operator: D. Kremer

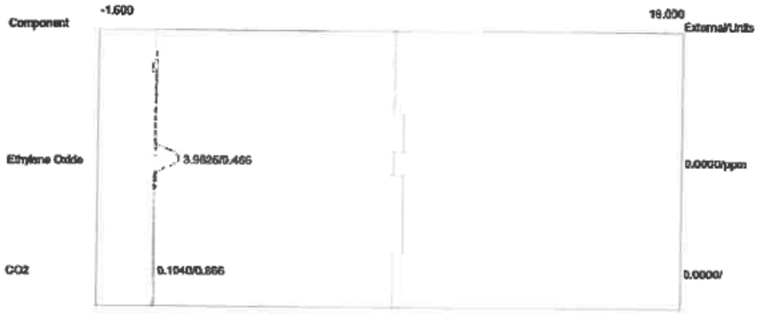
Component	Retention	Area	External	Units
Dead Vol / Air	0.066	0.1620	0.0000	
Ethylene Oxide	0.466	3.9790	0.0000	ppm
CO2	0.966	0.3260	0.0000	
		4.4670	0.0000	

Lab name: ECSi
Client: Sterigenics - Willowbrook 2
Client ID: PreCal
Analysis date: 09/20/2018 10:19:14
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2Ster2WB2018-C05.CHR (c:\peak359)
Sample: 10.1 ppm std
Operator: D. Kremer



Component	Retention	Area	External	Units
Dead Vol / Air	0.066	0.5750	0.0000	
Ambient H2O	0.316	0.0080	0.0000	
Ethylene Oxide	0.500	25.5700	0.0000	ppm
Acetaldehyde	0.750	0.2290	0.0000	
CO2	0.883	0.1175	0.0000	
		26.4995	0.0000	

Lab name: ECSi
Client: Sterigenics - Willowbrook 2
Client ID: PreCal
Analysis date: 09/20/2018 10:23:22
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1Ster2WB2018-C06.CHR (c:\peak359)
Sample: 10.1 ppm std
Operator: D. Kremer



Component	Retention	Area	External	Units
Ethylene Oxide	0.466	3.9625	0.0000	ppm
CO2	0.866	0.1040	0.0000	
		4.0665	0.0000	

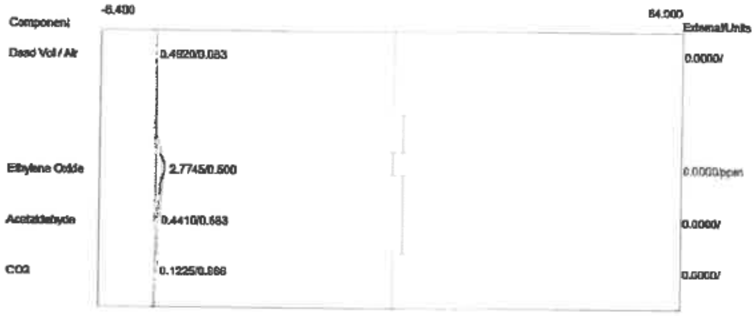
Lab name: ECSi
Client: Sterigenics - Willowbrook 2
Client ID: PreCal
Analysis date: 09/20/2018 10:23:22
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2Ster2WB2018-C06.CHR (c:\peak359)
Sample: 10.1 ppm std
Operator: D. Kremer

Component	Retention	Area	External	Units
Dead Vol / Air	0.066	0.4220	0.0000	
Ethylene Oxide	0.483	25.6900	0.0000	ppm
Acetaldehyde	0.783	0.1310	0.0000	
		26.2430	0.0000	

Lab name: ECSi
Client: Sterigenics - Willowbrook 2
Client ID: PreCal
Analysis date: 09/20/2018 10:30:30
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1Ster2WB2018-C07.CHR (c:\peak359)
Sample: 1.10 ppm std
Operator: D. Kremer

Component	Retention	Area	External	Units
Dead Vol / Air	0.066	0.1995	0.0000	
Ethylene Oxide	0.466	0.4310	0.0000	ppm
Acetaldehyde	0.666	0.2640	0.0000	
		0.8945	0.0000	

Lab name: ECSi
Client: Sterigenics - Willowbrook 2
Client ID: PreCal
Analysis date: 09/20/2018 10:30:30
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2Ster2WB2018-C07.CHR (c:\peak359)
Sample: 1.10 ppm std
Operator: D. Kremer

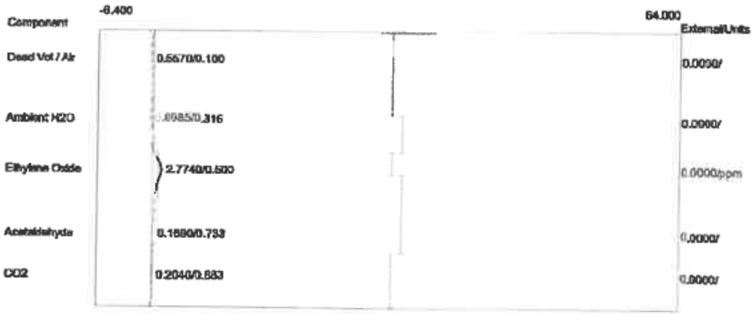


Component	Retention	Area	External	Units
Dead Vol / Air	0.083	0.4920	0.0000	
Ethylene Oxide	0.500	2.7745	0.0000	ppm
Acetaldehyde	0.683	0.4410	0.0000	
CO2	0.866	0.1225	0.0000	
		3.8300	0.0000	

Lab name: ECSi
Client: Sterigenics - Willowbrook 2
Client ID: PreCal
Analysis date: 09/20/2018 10:34:48
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1Ster2WB2018-C08.CHR (c:\peak359)
Sample: 1.10 ppm std
Operator: D. Kremer

Component	Retention	Area	External	Units
Ethylene Oxide	0.466	0.4370	0.0000	ppm
		0.4370	0.0000	

Lab name: ECSi
Client: Sterigenics - Willowbrook 2
Client ID: PreCal
Analysis date: 09/20/2018 10:34:48
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2Ster2WB2018-C08.CHR (c:\peak359)
Sample: 1.10 ppm std
Operator: D. Kremer



Component	Retention	Area	External	Units
Dead Vol / Air	0.100	0.5570	0.0000	
Ambient H2O	0.316	0.0985	0.0000	
Ethylene Oxide	0.500	2.7740	0.0000	ppm
Acetaldehyde	0.733	0.1690	0.0000	
CO2	0.883	0.2040	0.0000	
		3.8025	0.0000	

Lab name: ECSI
Client: Sterigenics - Willowbrook 2
Client ID: PreCal
Analysis date: 09/20/2018 10:39:28
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1Ster2WB2018-C09.CHR (c:\peak359)
Sample: 1.10 ppm std
Operator: D. Kremer

Component	Retention	Area	External	Units
Dead Vol / Air	0.066	0.3780	0.0000	
Ethylene Oxide	0.466	0.4320	0.0000	ppm
		0.8100	0.0000	

Lab name: ECSI
Client: Sterigenics - Willowbrook 2
Client ID: PreCal
Analysis date: 09/20/2018 10:39:28
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2Ster2WB2018-C09.CHR (c:\peak359)
Sample: 1.10 ppm std
Operator: D. Kremer

Component	Retention	Area	External	Units
Dead Vol / Air	0.066	0.6390	0.0000	
Ethylene Oxide	0.500	2.7610	0.0000	ppm
Acetaldehyde	0.616	0.1340	0.0000	
CO2	0.850	0.0080	0.0000	
		3.5420	0.0000	

Lab name: ECSI
Client: Sterigenics - Willowbrook 2
Client ID: PreCal
Analysis date: 09/20/2018 14:15:26
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1Ster2WB2018-C14.CHR (c:\peak359)
Sample: 100 ppm Sample Line Bias
Operator: D. Kremer

Component	Retention	Area	External	Units
Dead Vol / Air	0.050	0.1620	0.0000	
Ambient H2O	0.316	0.5600	0.0000	
Ethylene Oxide	0.466	40.2225	102.1508	ppm
CO2	0.966	2.5210	0.0000	
		43.4655	102.1508	

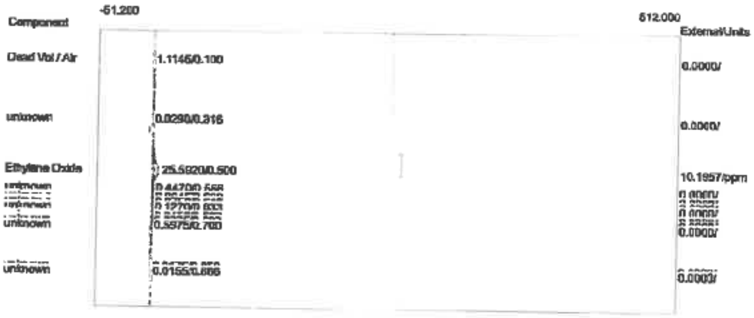
Lab name: ECSI
Client: Sterigenics - Willowbrook 2
Client ID: PreCal
Analysis date: 09/20/2018 14:07:47
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2Ster2WB2018-C11.CHR (c:\peak359)
Sample: 100 ppm Sample Line Bias
Operator: D. Kremer

Component	Retention	Area	External	Units
Dead Vol / Air	0.083	3.4670	0.0000	
Ethylene Oxide	0.500	254.8000	101.5108	ppm
Acetaldehyde	0.750	0.2415	0.0000	
CO2	0.816	0.0980	0.0000	
		258.6065	101.5108	

Lab name: ECSi
Client: Sterigenics - Willowbrook 2
Client ID: PostCal
Analysis date: 09/20/2018 17:55:27
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1Ster2WB2018-C15.CHR (c:\peak359)
Sample: 100 ppm std sample line bias
Operator: D. Kremer

Component	Retention	Area	External	Units
Dead Vol / Air	0.050	0.3770	0.0000	
Ethylene Oxide	0.466	39.7415	100.9292	ppm
		40.1185	100.9292	

Lab name: ECSi
Client: Sterigenics - Willowbrook 2
Client ID: ~~Run#3BV~~ PostCal
Analysis date: 09/20/2018 18:09:26
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2Ster2WB2018-C12.CHR (c:\peak359)
Sample: ~~AAP Outlet~~ 10 ppm std sample line bias
Operator: D. Kremer



Component	Retention	Area	External	Units
Dead Vol / Air	0.100	1.1145	0.0000	
Ethylene Oxide	0.500	25.5920	10.1957	ppm
		26.7065	10.1957	

APPENDIX J

Gas Certifications

ECSi

CERTIFIED WORKING CLASS

Single-Certified Calibration Standard

Scott Specialty Gases
500 CAJON BLVD., SAN BERNARDINO, CA 92411
Phone: 909-887-2571 Fax: 909-887-0549

CERTIFICATE OF ACCURACY: Certified Working Class Calibration Standard

Product Information
Project No.: 02-57164-001
Item No.: 02020001310TCL
P.O. No.: VBL – D. KREMER

Cylinder Number: CAL4448
Cylinder Size: CL
Certification Date: 20Apr2018

Customer

ECSI, INC
PO BOX 1498
SAN CLEMENTE, CA 92674

CERTIFIED CONCENTRATION

Component Name	Concentration (Moles)		Accuracy (+/-%)
ETHYLENE OXIDE	1.10	PPM	5
NITROGEN		BALANCE	

TRACEABILITY

Traceable To

Scott Reference Standard

APPROVED BY: MT

DATE: 4-20-18

SPECIFICATIONS

Component Name	Requested Concentration (Moles)		Certified Concentration (Moles)		Blend Tolerance Result (+/- %)	Certified Accuracy Result (+/- %)
ETHYLENE OXIDE	1.	PPM	1.10	PPM	10.0	5.00
NITROGEN		BAL		BAL		

TRACEABILITY

Traceable To
Scott Reference Standard

PHYSICAL PROPERTIES

Cylinder Size: CL

Pressure: 1200 PSIG
Expiration Date: 20Apr2020

SPECIAL HANDLING INSTRUCTIONS

Do not use or store cylinder at or below the stated dew point temperature. Possible condensation of heavier components could result. In the event the cylinder has been exposed to temperatures at or below the dew point, place cylinder in heated area for 24 hours and then roll cylinder for 15 minutes to re-mix.

Use of calibration standards at or below dew point temperature may result in calibration error.

COMMENTS

Scott Specialty Gases
00 CAJON BLVD., SAN BERNARDINO, CA 92411
Phone: 909-887-2571 Fax: 909-887-0549

CERTIFIED WORKING CLASS

Single-Certified Calibration Standard

CERTIFICATE OF ACCURACY: Certified Working Class Calibration Standard

Product Information
Project No.: 02-57164-003
Item No.: 02020001320TCL
P.O. No.: VBL – D. KREMER

Cylinder Number: CLM003232
Cylinder Size: CL
Certification Date: 20Apr2018

Customer

ECSI, INC
PO BOX 1498
SAN CLEMENTE, CA 92674

CERTIFIED CONCENTRATION

Component Name	Concentration (Moles)		Accuracy (+/-%)
ETHYLENE OXIDE	10.1	PPM	5
NITROGEN		BALANCE	

TRACEABILITY

Traceable To

Scott Reference Standard

APPROVED BY: MT (signature: MT)

DATE: 4-20-18

SPECIFICATIONS

Component Name	Requested Concentration (Moles)		Certified Concentration (Moles)		Blend Tolerance Result (+/- %)	Certified Accuracy Result (+/- %)
ETHYLENE OXIDE	10.	PPM	10.1	PPM	1.0	5.00
NITROGEN		BAL		BAL		

TRACEABILITY

Traceable To
Scott Reference Standard

PHYSICAL PROPERTIES

Cylinder Size: CL

Pressure: 1200 PSIG
Expiration Date: 20Apr2020

SPECIAL HANDLING INSTRUCTIONS

Do not use or store cylinder at or below the stated dew point temperature. Possible condensation of heavier components could result. In the event the cylinder has been exposed to temperatures at or below the dew point, place cylinder in heated area for 24 hours and then roll cylinder for 15 minutes to re-mix.

Use of calibration standards at or below dew point temperature may result in calibration error.

COMMENTS

CERTIFIED WORKING CLASS

Single-Certified Calibration Standard

Scott Specialty Gases

500 CAJON BLVD., SAN BERNARDINO, CA 92411

Phone: 909-887-2571 Fax: 909-887-0549

CERTIFICATE OF ACCURACY: Certified Working Class Calibration Standard

Product Information
Project No.: 02-57164-004
Item No.: 02020001330TCL
P.O. No.: VBL – D. KREMER

Cylinder Number: CLM011385
Cylinder Size: CL
Certification Date: 20Apr2018

Customer

ECSI, INC
PO BOX 1498
SAN CLEMENTE, CA 92674

CERTIFIED CONCENTRATION

Component Name	Concentration (Moles)		Accuracy (+/-%)
ETHYLENE OXIDE	100.	PPM	5
NITROGEN		BALANCE	

TRACEABILITY

Traceable To

Scott Reference Standard

APPROVED BY: B. McCully BLM

DATE: 4-20-18

SPECIFICATIONS

Component Name	Requested Concentration (Moles)		Certified Concentration (Moles)		Blend Tolerance Result (+/- %)	Certified Accuracy Result (+/- %)
ETHYLENE OXIDE	100.	PPM	100.	PPM	.0	5.00
NITROGEN		BAL		BAL		

TRACEABILITY

Traceable To
Scott Reference Standard

PHYSICAL PROPERTIES

Cylinder Size: CL

Pressure: 1300 PSIG
Expiration Date: 20Apr2020

Valve Connection: CGA 350

SPECIAL HANDLING INSTRUCTIONS

Do not use or store cylinder at or below the stated dew point temperature. Possible condensation of heavier components could result. In the event the cylinder has been exposed to temperatures at or below the dew point, place cylinder in heated area for 24 hours and then roll cylinder for 15 minutes to re-mix.

Use of calibration standards at or below dew point temperature may result in calibration error.

COMMENTS

CERTIFIED WORKING CLASS

Single-Certified Calibration Standard

Scott Specialty Gases

[illegible]00 CAJON BLVD., SAN BERNARDINO, CA 92411

Phone: 909-887-2571 Fax: 909-887-0549

CERTIFICATE OF ACCURACY: Certified Working Class Calibration Standard

Product Information
Project No.: 02-57164-005
Item No.: 02020001340TCL
P.O. No.: VBL – D. KREMER

Cylinder Number: CLM002810
Cylinder Size: CL
Certification Date: 20Apr2018

Customer

ECSI, INC
PO BOX 1498
SAN CLEMENTE, CA 92674

CERTIFIED CONCENTRATION

Component Name	Concentration (Moles)		Accuracy (+/-%)
ETHYLENE OXIDE	1,000.	PPM	5
NITROGEN		BALANCE	

TRACEABILITY

Traceable To

Scott Reference Standard

APPROVED BY: B. McCall
BLM

DATE: 4-20-18

SPECIFICATIONS

Component Name	Requested Concentration (Moles)		Certified Concentration (Moles)		Blend Tolerance Result (+/- %)	Certified Accuracy Result (+/- %)
ETHYLENE OXIDE	1,000.	PPM	1,000.	PPM	.0	5.00
NITROGEN		BAL		BAL		

TRACEABILITY

Traceable To
Scott Reference .Standard

PHYSICAL PROPERTIES

Cylinder Size: CL

Pressure: 1200 PSIG
Expiration Date: 20Apr2020

Valve Connection: CGA 350

SPECIAL HANDLING INSTRUCTIONS

Do not use or store cylinder at or below the stated dew point temperature. Possible condensation of heavier components could result. In the event the cylinder has been exposed to temperatures at or below the dew point, place cylinder in heated area for 24 hours and then roll cylinder for 15 minutes to re-mix.

Use of calibration standards at or below dew point temperature may result in calibration error.

COMMENTS

CERTIFIED WORKING CLASS

Single-Certified Calibration Standard

Scott Specialty Gases
500 CAJON BLVD., SAN BERNARDINO, CA 92411
Phone: 909-887-2571 Fax: 909-887-0549

CERTIFICATE OF ACCURACY: Certified Working Class Calibration Standard

Product Information
Project No.: 02-57164-006
Item No.: 02020001340TCL
P.O. No.: VBL – D. KREMER

Cylinder Number: CLM005787
Cylinder Size: CL
Certification Date: 20Apr2018

Customer

ECSI, INC
PO BOX 1498
SAN CLEMENTE, CA 92674

CERTIFIED CONCENTRATION

Component Name	Concentration (Moles)		Accuracy (+/-%)
ETHYLENE OXIDE	10,080.	PPM	5
NITROGEN		BALANCE	

TRACEABILITY

Traceable To

Scott Reference Standard

APPROVED BY: B. McCully
B M

DATE: 4-20-18

SPECIFICATIONS

Component Name	Requested Concentration (Moles)		Certified Concentration (Moles)		Blend Tolerance Result (+/- %)	Certified Accuracy Result (+/- %)
ETHYLENE OXIDE	10,000.	PPM	10,080.	PPM	.8	5.00
NITROGEN		BAL		BAL		

TRACEABILITY

Traceable To
Scott Reference Standard

PHYSICAL PROPERTIES

Cylinder Size: CL

Pressure: 700 PSIG
Expiration Date: 20Apr2020

Valve Connection: CGA 350

SPECIAL HANDLING INSTRUCTIONS

Do not use or store cylinder at or below the stated dew point temperature. Possible condensation of heavier components could result. In the event the cylinder has been exposed to temperatures at or below the dew point, place cylinder in heated area for 24 hours and then roll cylinder for 15 minutes to re-mix.

Use of calibration standards at or below dew point temperature may result in calibration error.

COMMENTS

CERTIFICATE OF ANALYSIS

Customer Name:	BCSi, Inc.	**Cylinder Number:**	SA25925
Stock or Analyzer Tag Number:	N/A	**Product Class:**	Certified Standard
Customer Reference:	Verbal- Dan	**Cylinder - Contents[1]:**	28 CF @ 2000 PSI
MESA Reference:	104448	**Cylinder-CGA:**	A006-HP-BR/350
Date of Certification:	4/19/2018	**Analysis Method:**	GC-TCD/FID
Recommended Shelf Life:	2 Years	**Preparation Method:**	Gravimetric

Component	Requested Concentration[2]	Reported Concentration[2,3]
Ethylene Oxide	50 ppm	48.8 ppm
Nitrogen	Balance	Balance

Authorized Signature:

1. The fill pressure shown on the COA is as originally quoted. The fill pressure measured by the customer may differ from the fill pressure originally quoted due to temperature effects, compressibility of the individual components when blended together in the cylinder, gauge accuracy or reduction in content volume before shipping as a result of samples withdrawn for laboratory QC necessary to ensure product quality.
2. Unless otherwise stated, concentrations are given in molar units.
3. Vapor pressure mixes are blended at a sufficiently low pressure so as to eliminate phase separation under most low temperature conditions encountered during transport or storage. However, it is generally recommended that cylinders containing vapor pressure restricted mixes be placed on the floor in a horizontal position and rolled back and forth to improve homogeneity of the gas phase mixture before being put into service.

Analytical Gas Standards are prepared and analyzed using combinations of NIST traceable weights, SRM's provided by NIST, or internal gas standards that have been verified for accuracy using procedures published by the US-EPA. Pure gases are analyzed and certified for purity using minor component Analytical Gas Standards prepared according to the methods specified above. Balances are calibrated to NIST test weights covered by NIST test number 822/256175/96. Reference Certification #'s: 163/W, 830/N and 3280. Calibration methods are in conformance with MIL-STD 45662A.

MESA Specialty Gases & Equipment
division of MESA International Technologies, Inc.
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TEL.: 714-434-7102 ♦ FAX: 714-434-8006 ♦ E-mail: mail@mesagas.com
On-line Catalog at www.mesagas.com

APPENDIX K

Limit of Detection

ECSi

Detection Limit Study

Step 1 : Prepare and analyze at least seven standards prepared at or near the estimated detection limit

Step 2 : Record and calculate the standard deviation of the replicate measurements.

Analysis Number	1	2	3	4	5	6	7	8	9	10
Result	1.007	1.011	1.015	1.01	1.071	1.071	1.067			

Calculated Standard Deviation = 0.0316

Step 3 : Determine the Method Detection Limit (MDL) by mulitplying the student T value appropriate for 99% confidence level and the standard deviation estimate with in n-1 degrees of freedom

Number of Replicates	7	8	9	10
T-values	3.143	2.998	2.896	2.821

Method Detection Limit: = 0.10

Wagner, Kevin

From: Hoffman, Kathy
Sent: Tuesday, September 25, 2018 8:42 AM
To: Wagner, Kevin
Subject: FW: MDL calculations and additional information.
Attachments: Detection Limit Master Spreadsheet.xls

From: Shappley, Ned [mailto:Shappley.Ned@epa.gov]
Sent: Monday, September 24, 2018 12:02 PM
To: Hoffman, Kathy; dankremer@ecsi1.com
Cc: Sieffert, Margaret; Mattison, Kevin; Merrill, Raymond; Johnson, Steffan
Subject: MDL calculations and additional information.

Dan/Kathy,

As we discussed on site, attached is the spreadsheet (Note, this is not an official EPA spreadsheet) I used to determine the MDL (i.e., LOD) for the testing last week at Sterigenics. It is important to include all raw data associated with this study as well as a discussion of the procedures used. The reference for how MDL studies should be performed can be found in Section 15.2 of Method 301 (40 CFR Part 63), which links you to 40 CFR Part 136, Appendix B (see below). In this instance, I am making the recommendation to Illinois EPA to accept this MDL study with just spiked samples and collected over a shorter time period.

Based on the 7 replicate values I calculated using the low calibration response, in lieu of reporting a ND, you should report a <0.10 ppm for the measured concentration. It is important to use this MDL value when calculating the DRE. Going forward you should consider repeating the MDL for each test program or include a MDL verification step to ensure that your system is capable of measuring at these low-levels. For future MDL studies, it is strongly suggested you develop an MDL using a similar matrix (i.e., in air) as opposed to a calibration gas cylinder. I suggest filling a Tedlar bag with carbon-free air and injecting a concentration of EtO into the bag targeting a concentration in the Tedlar Bag of approximately 0.3 to 0.5 ppm. This type of evaluation would best replicate the sample matrix as measured by the GC.

Additional Information:

Going forward, it is important to use the procedures that were utilized during the Sterigenics for future tests, making sure to 1) verify the sampling testing locations meet all Method 1 criteria, 2) performing all required velocity traverses as required by the method, 3) use of heated sampling system (Method 18 – Section 8.2.2.1.1 and 8.2.2.1.2) to prevent moisture or organic condensation, 4) perform a successful recovery study for direct interface sampling (Method 18 – Section 8.4.1) to verify the efficacy of the sampling system, and 5) to select calibration standards that bracket the sample concentrations (Method 18 – Section 8.2.4.3). These are not recommendations, they are requirements of the method and failure to follow these procedures could be grounds for a regulatory authority to invalidate a test.

Please let me know if you have any questions,

Ned Shappley

40 CFR Part 136, Appendix B

....

(a) Select a spiking level, typically 2—10 times the estimated MDL in Section 1. Spiking levels in excess of 10 times the estimated detection limit may be required for analytes with very poor recovery (e.g., for an analyte with 10% recovery, spiked at 100 micrograms/L, with mean recovery of 10 micrograms/L; the calculated MDL may be around 3 micrograms/L. Therefore, in this example, the spiking level would be 33 times the MDL, but spiking lower may result in no recovery at all).

(b) Process a minimum of seven spiked samples and seven method blank samples through all steps of the method. The samples used for the MDL must be prepared in at least three batches on three separate calendar dates and analyzed on three separate calendar dates. (Preparation and analysis may be on the same day.) Existing data may be used, if compliant with the requirements for at least three batches, and generated within the last twenty four months. The most recent available data for method blanks and spiked samples must be used. Statistical outlier removal procedures should not be used to remove data for the initial MDL determination, since the total number of observations is small and the purpose of the MDL procedure is to capture routine method variability. However, documented instances of gross failures (e.g., instrument malfunctions, mislabeled samples, cracked vials) may be excluded from the calculations, provided that at least seven spiked samples and seven method blanks are available. (The rationale for removal of specific outliers must be documented and maintained on file with the results of the MDL determination.)

……

(ii) Compute the MDL_s (the MDL based on spiked samples) as follows:
$MDL_S = t_{(n-1,\ 1-\alpha = 0.99)} S_s$
Where:
MDL_s *= the method detection limit based on spiked samples*
$t_{(n-1,\ 1-\alpha = 0.99)}$ *= the Student's t-value appropriate for a single-tailed 99th percentile t statistic and a standard deviation estimate with n-1 degrees of freedom. See Addendum Table 1.*
S_s *= sample standard deviation of the replicate spiked sample analyses.*

Ned Shappley | USEPA|OAQPS|AQAD|Measurement Technology Group
109 TW Alexander Drive (E143-02) | Research Triangle Park, NC 27711
email: shappley.ned@epa.gov | Phone (919)541-7903

APPENDIX L

Permits/Protocols

ECSi

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

1021 NORTH GRAND AVENUE EAST, P.O. BOX 19276, SPRINGFIELD, ILLINOIS 62794-9276 • (217) 782-3397
BRUCE RAUNER, GOVERNOR ALEC MESSINA, DIRECTOR

217/785-1705

CONSTRUCTION PERMIT
NESHAP SOURCE

PERMITTEE

Sterigenics US, LLC
Attn: Laura Hartman, EHS Manager
2015 Spring Road, Suite 650
Oak Brook, Illinois 60523

Application No.: 18060020 I.D. No.: 043110AAC
Applicant's Designation: Date Received: June 11, 2018
Subject: Control of the Backvents of the Sterilization Chambers
Date Issued: June 26, 2018
Location: 7775 Quincy and 830 Midway, Willowbrook, DuPage County

This Permit is hereby granted to the above-designated Permittee to CONSTRUCT emission source(s) and/or air pollution control equipment consisting of control of the backvents of the sterilization chambers, as described in the above-referenced application. This Permit is subject to standard conditions attached hereto and the following special condition(s):

1. Introduction

   a. This permit authorizes control of the existing backvents of the five sterilization chambers (SC-1, SC-2, SC-3, SC-4 and SC-5) at Sterigenic's Willowbrook facilities using the existing control systems that control emissions of ethylene oxide from the vacuum pumps and from aeration.

   b. This permit does not authorize changes to the sterilization chambers or other emission units at the source that would increase their capacity or emissions.

   c. For purposes of this permit, the existing sterilization chambers after their backvents are also connected to control systems are referred to as the "affected units."

2. Existing Requirements

   This permit does alter established requirements for the affected units, (i.e., applicable emission standards and requirements for testing, monitoring, recordkeeping and reporting), as identified in Sections 4.1 and 4.2 of the Clean Air Act Permit Program (CAAPP) permit for the source, Permit No. 95120085, issued June 8, 2015. In particular, the affected units will continue to be subject to federal National Emission Standards for Hazardous Air Pollutants (NESHAP) for Ethylene Oxide Emissions from Sterilization Facilities, 40 CFR 63 Subpart O.

3. Non-applicability Provisions

This permit is issued based on this project not constituting a major modification for purposes of the state rules for Major Stationary Sources Construction and Modification (MSSCAM), 35 IAC Part 203. This is because this project is an emission reduction project that will reduce emissions of volatile organic material.

4. Good Air Pollution Control Practices

At all times, the Permittee shall maintain and operate the affected units and associated air pollution control systems in a manner consistent with good air pollution control practices for minimizing emissions.

5. Notification

The Permittee shall notify the Illinois EPA within 30 days after completion of this project. This notification shall include the date that the backvent on each affected unit is first controlled.

6. Testing

a. Within 180 days of completion of this project, for the affected units, the Permittee shall perform performance testing in accordance with 40 CFR 63.365 and 63.7. The Permittee shall submit applicable notifications and reports for this testing as required by 40 CFR 63.7, 63.360, 63.365 and 63.366.

b. The following USEPA methods and procedures shall be used for testing, unless another USEPA method is approved by the Illinois EPA:

Flowrate	Method 2, 2A, 2B, 2C or 2D
Oxygen (O_2)/Carbon Dioxide (CO_2)	Method 3A or 3B
Moisture	Method 4 or 320
Ethylene Oxide/Propylene Oxide	Method 18 or 320

c. The Permittee shall submit a written test plan to the Illinois EPA for this testing and if a significant change in the procedures for this testing is planned from the procedures followed in the previous test. This plan shall be submitted at least 30 days prior to the actual date of testing and include the following information as a minimum:

i. A description of the planned test procedures.

ii. The person(s) who will be performing sampling and analysis and their experience with similar tests.

iii. The specific conditions under which testing will be performed, including a discussion of why these conditions will be representative of maximum emissions and the means or manner by which the operating parameters for the emission unit and any control equipment will be determined.

iv. The specific determinations of emissions and operation that are intended to be made, including sampling and monitoring locations.

v. The test method(s) that will be used, with the specific analysis method, if the method can be used with different analysis methods.

d. The Permittee shall notify the Illinois EPA prior to conducting these measurements to enable the Illinois EPA to observe testing. Notification for the expected date of testing shall be submitted a minimum of 30 days prior to the expected date. Notification of the actual date and expected time of testing shall be submitted a minimum of 5 working days prior to the actual date of the test. The Illinois EPA may accept shorter advance notice if it does not interfere with the Illinois EPA's ability to observe testing.

e. Copies of the Final Report(s) for these tests shall be submitted to the Illinois EPA within 30 days after the test results are compiled and finalized but no later than 60 days after completion of sampling. The Final Report shall include as a minimum:

i. General information, i.e., date of test, names of testing personnel, and names of Illinois EPA observers.

ii. A summary of results, e.g., VOM emissions, pounds.

iii. A detailed description of operating conditions of the emission unit(s) during testing, including:

A. Process information, i.e., mode(s) of operation, process rate, e.g. fuel or raw material consumption.

B. Control equipment information, i.e., equipment condition and operating parameters during testing.

C. A discussion of any preparatory actions taken, i.e., inspections, maintenance and repair.

iv. Description of test method(s), including description of sampling points, sampling train, analysis equipment, and test schedule.

v. Data and calculations, including copies of all raw data sheets and records of laboratory analyses, sample calculations, and data on equipment calibration.

vi. Conclusions.

f. The Permittee shall retain copies of emission test reports for at least three years beyond the date that an emission test is superseded by a more recent test.

7. <u>Authorization to Operate</u>

The Permittee may operate the affected units with backvents ducted to the existing control systems pursuant to this construction permit until the CAAPP permit for the source is revised to address this project. This condition supersedes Standard Condition 6.

Please note that the Illinois EPA has not acted in this permit on Sterigenic's request for enforceable limits on the operation and emissions of its Willowbrook facilities so that this source is not a major source under relevant air pollution control regulations. The Illinois EPA is processing that request as a separate application.

If you have any questions on this permit, please contact Daniel Rowell at 217/558-4368.

Raymond E. Pilapil
Manager, Permit Section
Bureau of Air

REP:DBR:jlp
DBR
6/26/18

STATE OF ILLINOIS
ENVIRONMENTAL PROTECTION AGENCY
DIVISION OF AIR POLLUTION CONTROL
P. O. BOX 19506
SPRINGFIELD, ILLINOIS 62794-9506

STANDARD CONDITIONS FOR CONSTRUCTION/DEVELOPMENT PERMITS ISSUED BY THE ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

July 1, 1985

The Illinois Environmental Protection Act (Illinois Revised Statutes, Chapter 111-1/2, Section 1039) authorizes the Environmental Protection Agency to impose conditions on permits which it issues.

The following conditions are applicable unless superseded by special condition(s).

1. Unless this permit has been extended or it has been voided by a newly issued permit, this permit will expire one year from the date of issuance, unless a continuous program of construction or development on this project has started by such time.

2. The construction or development covered by this permit shall be done in compliance with applicable provisions of the Illinois Environmental Protection Act, and Regulations adopted by the Illinois Pollution Control Board.

3. There shall be no deviations from the approved plans and specifications unless a written request for modification, along with plans and specifications as required, shall have been submitted to the Agency and a supplemental written permit issued.

4. The Permittee shall allow any duly authorized agent of the Agency upon the presentation of credentials, at reasonable times:

   a. to enter the Permittee's property where actual or potential effluent, emission or noise sources are located or where any activity is to be conducted pursuant to this permit,

   b. to have access to and copy any records required to be kept under the terms and conditions of this permit,

   c. to inspect, including during any hours of operation of equipment constructed or operated under this permit, such equipment and any equipment required to be kept, used, operated, calibrated and maintained under this permit,

   d. to obtain and remove samples of any discharge or emission of pollutants, and

   e. to enter and utilize any photographic, recording, testing, monitoring or other equipment for the purpose of preserving, testing, monitoring, or recording any activity, discharge, or emission authorized by this permit.

5. The issuance of this permit:

   a. shall not be considered as in any manner affecting the title of the premises upon which the permitted facilities are to be located,

   b. does not release the Permittee from any liability for damage to person or property caused by or resulting from the construction, maintenance, or operation of the proposed facilities,

   c. does not release the Permittee from compliance with the other applicable statues and regulations of the United States, of the State of Illinois, or with applicable local laws, ordinances and regulations,

   d. does not take into consideration or attest to the structural stability of any units or parts of the project, and

e. in no manner implies or suggests that the Agency (or its officers, agents or employees) assumes any liability, directly or indirectly, for any loss due to damage, installation, maintenance, or operation of the proposed equipment or facility.

6. a. Unless a joint construction/operation permit has been issued, a permit for operation shall be obtained from the Agency before the equipment covered by this permit is placed into operation.

   b. For purposes of shakedown and testing, unless otherwise specified by a special permit condition, the equipment covered under this permit may be operated for a period not to exceed thirty (30) days.

7. The Agency may file a complaint with the Board for modification, suspension or revocation of a permit:

   a. upon discovery that the permit application contained misrepresentations, misinformation or false statements or that all relevant facts were not disclosed, or

   b. upon finding that any standard or special conditions have been violated, or

   c. upon any violations of the Environmental Protection Act or any regulation effective thereunder as a result of the construction or development authorized by this permit.

From: "Armitage, Julie" <Julie.Armitage@Illinois.gov>
Date: September 7, 2018 at 6:34:23 PM CDT
To: "Hoffman, Kathy" <KHoffman@sterigenics.com>
Cc: "Mattison, Kevin" <Kevin.Mattison@Illinois.gov>

By this email, at your request, and to facilitate the shared goal of expedited emissions testing, the Bureau of Air provides notice that it is waiving the timeframe for test plan submittal (30 days prior to testing – condition 6c) and the timeframe for notification of expected and actual test dates (30 and 5 days, respectively – condition 6d) under construction permit No. 18060020 issued June 26, 2018. Also, the Bureau provides notice that, after review and consultation with the USEPA, it is accepting the protocol received August 28, 2018, and supplemented September 7, 2018, conditioned upon the testing scheduled for September 8th, being performed in accordance with USEPA reference methods and supported by a detailed final report that evidences the validity of the test, adherence to reference methods, and compliance with all relevant permit terms.

Should you have comments or questions regarding this matter, pleased direct them to my attention or to that of Kevin Mattison of my staff who will be present for the September 8th testing.

Sterigenics.
A Sotera Health company

September 7, 2018 Sent via email

Julie Armitage
Illinois Environmental Protection Agency
Bureau of Air
1021 North Grand Avenue East
Springfield, Illinois 62702

Kevin Mattison
Illinois Environmental Protection Agency
Bureau of Air / Compliance Section
9511 Harrison Street
Des Plaines, IL 60016

Re: Waiver Request of Construction Permit Test Notification Requirements, and Additional Test Protocol Information for Sterigenics Willowbrook I and II Facilities
Facility I.D. No: 043110AAC

Ms. Armitage and Mr. Mattison:

In our recent conversations, we discussed our shared interest in conducting performance testing of the Willowbrook facilities' control equipment as quickly as possible after recently tying in our sterilization chamber backvents into each facility's existing emission control equipment. This letter formally requests IEPA's waiver of the 30 and 5 day performance test notification requirements found in the project's Construction Permit (Application No. 18060020), at Conditions 6 c. and 6 d. If the waiver of notification requirements is granted, then we would plan to commence performance testing beginning in the morning on Saturday, September 8 at approximately 7:00am at Willowbrook I, 7775 Quincy Street. Testing at Willowbrook II will commence at approximately noon.

This letter also provides additional information regarding the previously submitted test protocol we submitted in our last letter. Based on guidance from Mr. Mattison, this information will serve to provide further details about the planned test procedures and how test results are to be generated. With this additional information, we also request that IEPA grant its approval of the updated test protocol.

Please contact me to further discuss this matter. You can reach me at 630-928-1771 or email: kwagner@sterigenics.com.

Regards,

Kevin Wagner
Director, EH&S

Enclosures:

Sterigenics.
A Sotera Health company

Test Protocol Addendum for both Willowbrook I and Willowbrook II

2.0 EQUIPMENT

Process parameters for both AAT emission control devices will be measured prior to testing. One measurement of the scrubber would be representative of scrubber conditions throughout the testing. Based on the total volume of the scrubber liquor, it isn't anticipated that an appreciable change in liquor level or pH will occur over the course of testing. In accordance with the site's air permit the scrubber tank level will be measured along with the liquor pH.

3.0 TESTING

Once a sterilization chamber cycle ends, our process requires the chamber door to be partially opened for 15 minutes which vents the EO in the chamber to reduce levels in the chamber and exposure to employees. The 15-minute duration ensures the highest concentration of EO is removed from the chamber prior to unloading the product. During this venting, EO exhausts thru the backvent and to the AAT scrubber. In accordance with our procedures, workers are not allowed to enter or unload the chamber until the 15-minute time period has passed. Once the 15-minutes has passed, the product is unloaded to the aeration room.

The Willowbrook facility utilizes different sterilization cycles based on FDA validated cycles. The EO concentration in the chamber prior to the backvent phase can vary. Therefore, the higher ending concentrations will represent the highest amount of EO exhausted thru the backvents to the AAT scrubber.

In order to meet Condition 6 of the Construction Permit, each test run will be completed on the backvents using freshly sterilized product from one chamber for a 15-minute duration, for a total of three test runs at each facility. The emission testing will use chambers with higher ending EO concentrations for testing. Each test interval will test the first 15-minutes the backvent is opened and exhausted to the scrubber. Once the 15 minutes ends, product will be unloaded from the chamber and placed into the aeration rooms which are continuously vented to the same AAT scrubber throughout the test.

Recording data

Sterigenics will record process data during the performance testing to identify which chamber was utilized and the sterilization cycle number for each test. This process data will be summarized in a table which will be provided in the final report. In addition to the process data collection, Sterigenics will record pH and scrubber liquor level of the AAT scrubber prior to the test. This information will also be furnished with the process data in the final report. Due to the AAT scrubber size and design, these parameters do not change significantly during the course of a day which exceeds the performance testing duration.

SECTION 5.0 TEST METHOD REFERENCE

The protocol indicated the CO2/O2 will not be measured, rather the stack will be assumed to be ambient air. The assumed molecular weight of the stack gas will be 29.

5.2 VOLUMETRIC FLOW MEASUREMENT

Method 2C will be utilized to test volumetric flow. The sample port used for the Method 18 inlet and outlet will be used for Method 2C. Please see attached Figure 1 for a drawing of the test locations in accordance with USEPA Method 1 or 1a. The absence of cyclonic flow will be verified during the test program.

5.4 SAMPLE TRANSPORT

In addition to the description of the sample transport in the protocol, the lines used for testing will be heated above 110°C. Source gas will be pumped to the GC with a response time of 5-10 seconds.

5.7 CALIBRATIONS

Calibration will be performed in triplicate prior to and at the end of each test day. Limit of detection will be determined.

6.0 TEST SCENARIO

As discussed above, backvent testing will be performed during normal process load conditions, with freshly sterilized product in the sterilization chambers. Three test runs will be conducted in series to verify the performance of the emission-control system.

Sterilization chamber cycles can range from 8 – 12 hours. Sterigenics will schedule three chambers to end the sterilization cycle to allow for the three test runs to run consecutively, however, due to the range in cycle time, it may be necessary to wait for the chamber cycle to end prior to beginning the subsequent testing.

The sample testing will begin at approximately 7:00 am on Saturday, September 8, 2018. The equipment will be set up Friday evening. Calibration of the chromatograph system will be completed prior to beginning the test at Willowbrook 1 and then again prior to beginning the test at Willowbrook 2.

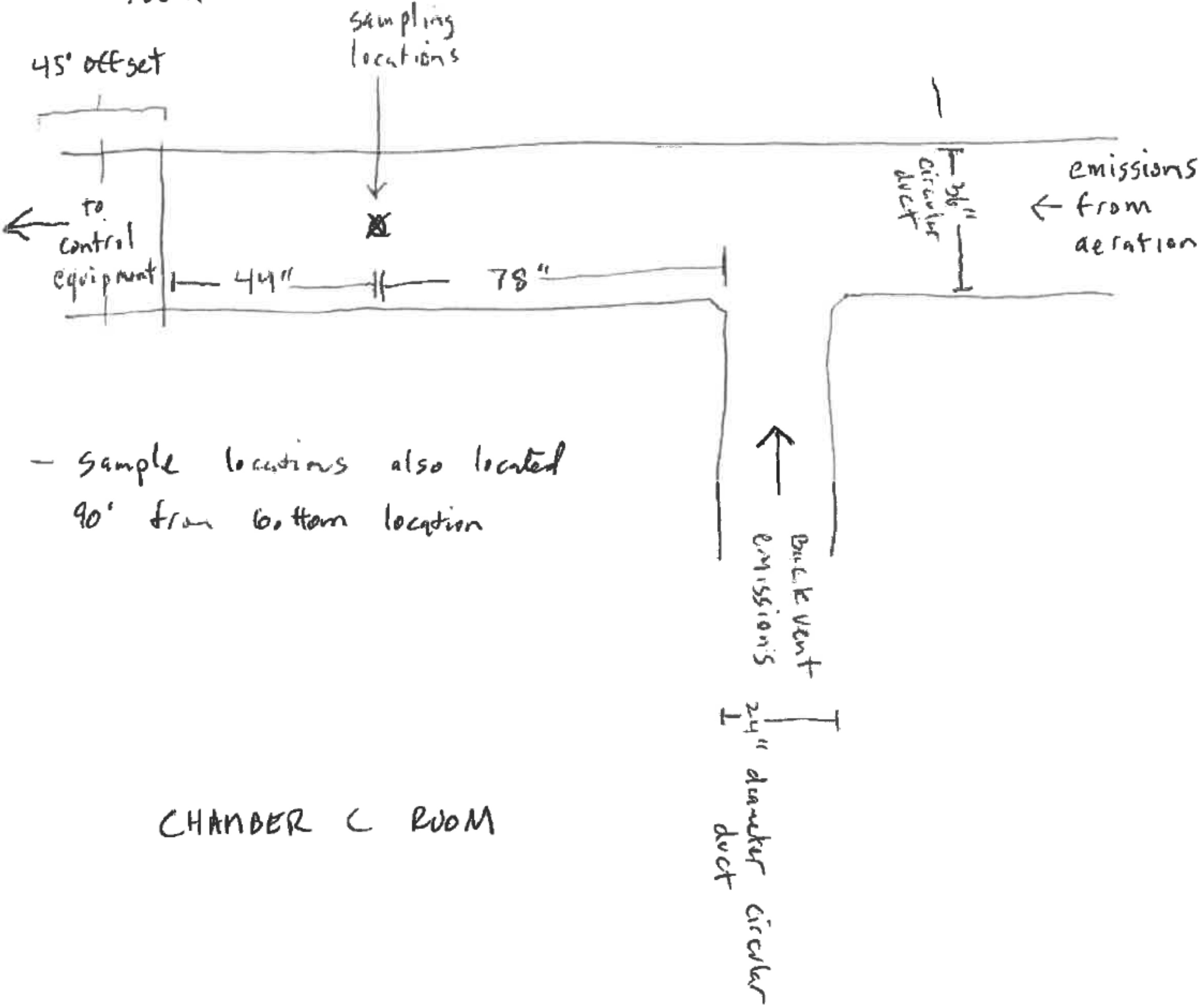
Sterigenics.
A Sotera Health company

Test Scenario Time Line

	Sequence for each facility	Method/Reference
	Sample port locations established	Method 1
	3-point calibration performed in triplicate.	Method 18
	Obtain meteorological data for sampling time. Conduct calculation based on Method 4.	Method 4
SAMPLE 1	Flow traverse of inlet and outlet conducted to establish measurement centroid, confirm absence of cyclonic flow.	Method 2
7:00 am	Chamber door opened, actuator switch activates backvent	N/A
	First sample initiated	Method 18
	Samples at inlet and outlet taken approximately every 1-minute for a total of 15-minutes	Method 18
	Flow monitoring sampled approximately every 1-minute.	
	Recovery study performed	Method 18
Each sample run will follow the same steps as sample 1		
End of 3 samples	Post calibration	

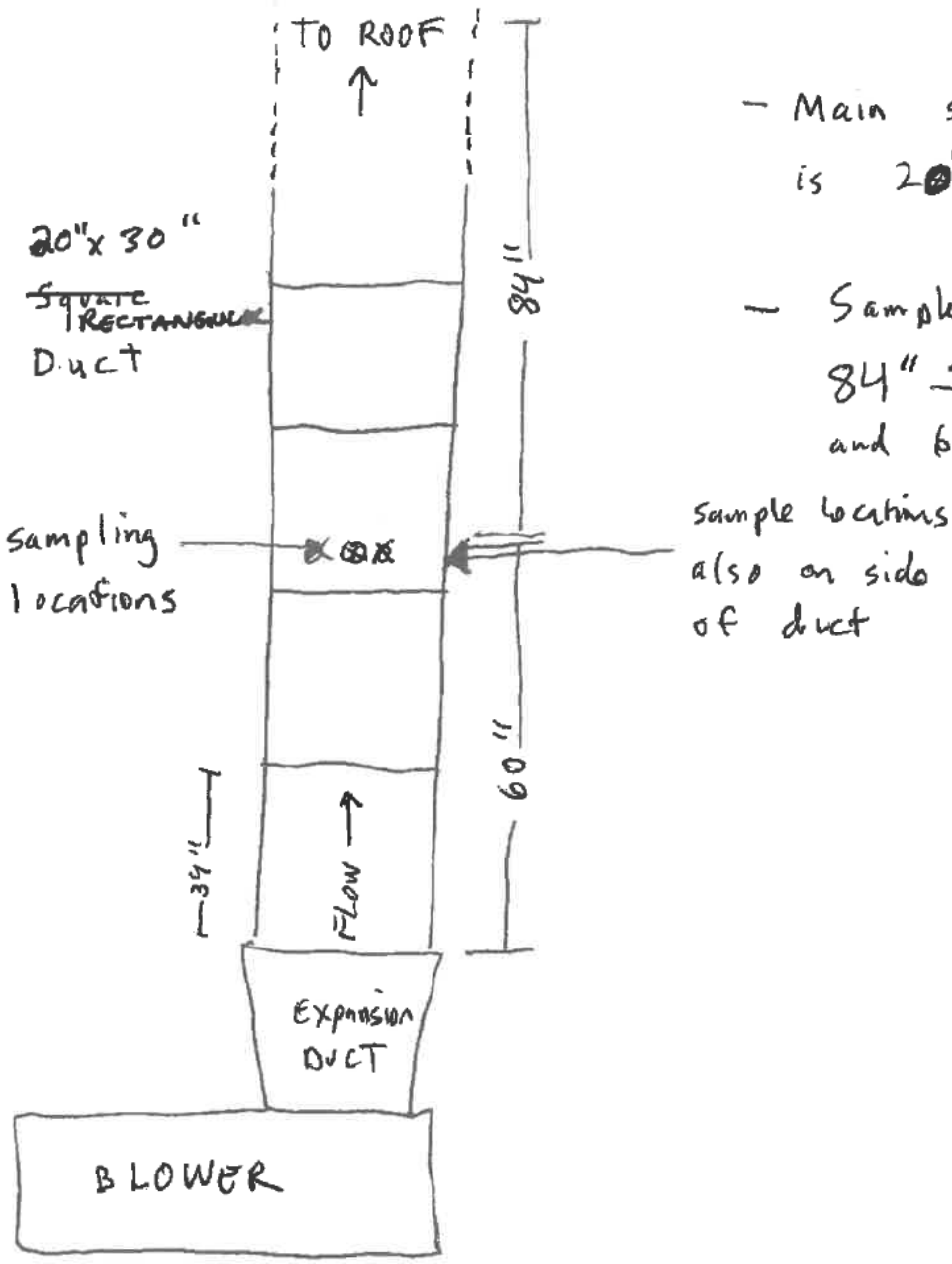
WB I INLET TEST LOCATION

- view is looking above at ceiling of chamber C room



- sample locations also located 90° from bottom location

WB I OUTLET TEST LOCATION

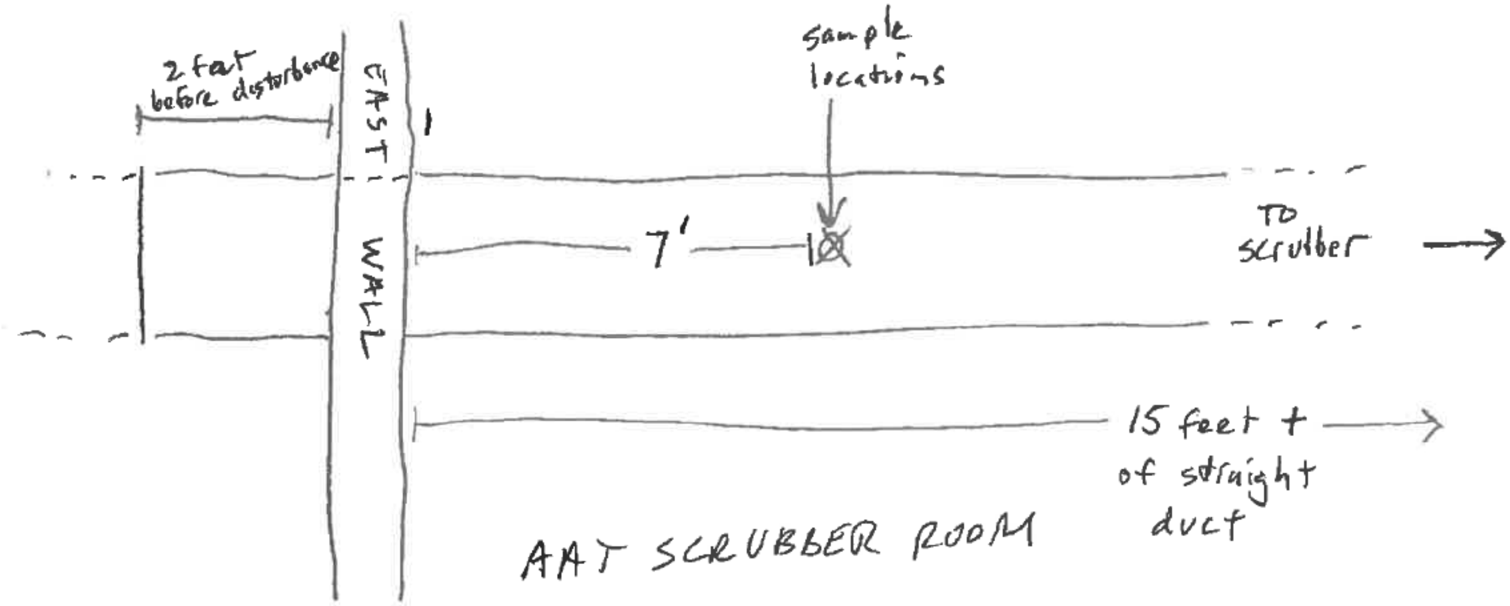


- Main stretch of ducting is 20"x 30" rectangular ~~square~~ duct
- Sample points are located 84" ~~from~~ below top-most disturbance and 60" above lowest disturbance

AAT DRYBED ROOM

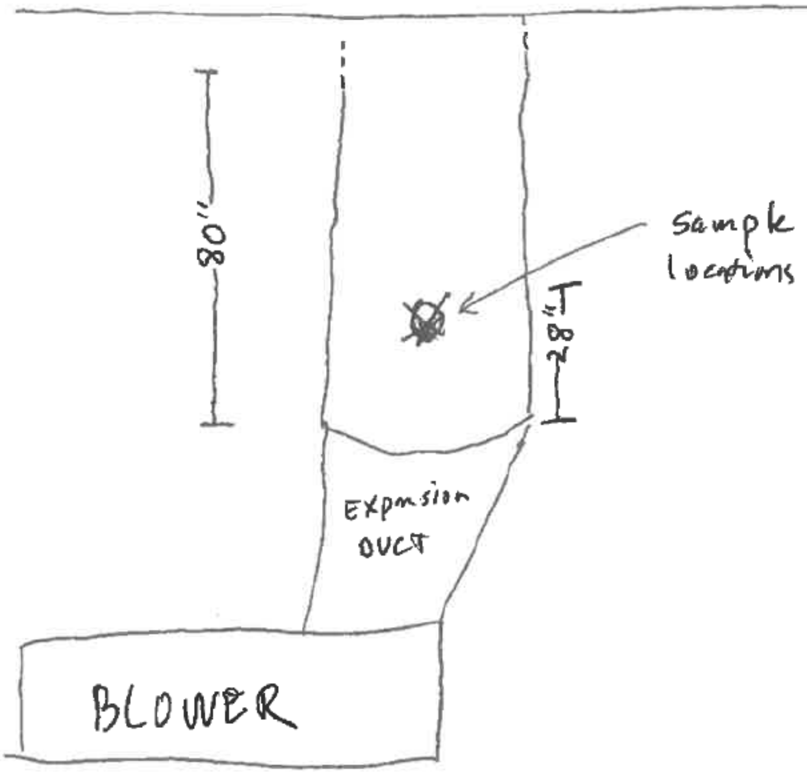
WB II INLET TEST LOCATION

- View is looking up at ceiling of AAT Scrubber Room



- sample locations also located 90' from bottom location.

WB II OUTLET TEST LOCATION



- 28" diameter circular duct
- sample locations also located 90° from front location

AAT DRYBED ROOM

* sample point will be located in straight run. Verified to meet Method prior to test.

TEST PROTOCOL FOR
AIR POLLUTION SOURCE TESTING
OF AN ETHYLENE OXIDE EMISSION-CONTROL SYSTEM
OPERATED BY STERIGENICS US, LLC.
AT ITS WILLOWBROOK II, ILLINOIS FACILITY

Submitted to:

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY
1021 North Grand Avenue East
Springfield, Illinois 62794

Submitted by:

STERIGENICS US, LLC.
830 Midway Drive
Willowbrook, Illinois 60521

I.D. Number 043110AAC

Prepared by:

ECSI, INC.
PO Box 1498
San Clemente, California 92674-1498

Prepared on:

August 24, 2018

ECSi

CONTACT SUMMARY

CLIENT

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Willowbrook, Illinois 60521

Phone: (630)654-5151
FAX: (630)325-0020
email: pkrett@sterigenics.com

TEST DATE

September 20-21, 2018

REGULATORY AGENCY

Daniel Rowell
Environmental Protection Engineer III
Bureau of Air – Air Permits Section
Illinois Environmental Protection Agency
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TESTING CONTRACTOR

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email: dankremer@ecsi1.com

TABLE OF CONTENTS

1.0 INTRODUCTION

ECSi, Inc. proposes to conduct air pollution source testing of the ethylene oxide (EtO) emission control system operated by Sterigenics US, LLC. at their Willowbrook II facility, located at 830 Midway Drive. The device to be tested is the two stage AAT Safe Cell packed tower scrubber/dry bed reactor emission-control system, which is used to control emissions from four sterilizer vacuum pumps, four sterilizer backvents and two aeration rooms. The purpose of the testing program will be to demonstrate compliance with backvent emission control requirements and the conditions established in the Air Quality Permit granted to Sterigenics by the Illinois Environmental Protection Agency (IEPA).

We have specialized exclusively in the performance of ethylene oxide source testing and leak testing since 1992, and are the nationally recognized expert in the field. When the current ethylene oxide emissions regulations were being implemented, we worked closely with the California Air Resources Board (CARB) and USEPA to help develop the currently used testing methodology.

2.0 EQUIPMENT

At Willowbrook I, sterilizer backvent emissions are controlled by:

- One two-stage Advanced Air Technologies Safe Cell emission-control system, comprised of a packed-tower chemical scrubber (SC1), equipped with a packed reaction/interface column, a scrubber fluid recirculation system, and a scrubber fluid reaction/storage tank, and a dry bed reactor/scrubber (SC2), comprised of a bank of solid-bed reaction vessels, connected in parallel, installed downstream of SC1 and upstream of a dedicated blower exhaust system.

3.0 TESTING

EtO source testing will be conducted in accordance with the procedures outlined in USEPA CFR40, Part 63.365, using USEPA Method 18 as specified. EtO emissions monitoring will be conducted simultaneously at the inlet and outlet of the Safe Cell System (the inlet of SC1 and the outlet of SC2) during the entire duration of the backvent phase of one of the four sterilizers. A total of three backvent-phase test runs will be performed.

During the backvent phase, EtO emissions at the inlet and the outlet of the Safe Cell System will be determined using direct source sample injection into a gas chromatograph (GC). All testing will be conducted during normal process load conditions. All backvent testing will be performed with freshly sterilized product in the sterilizer. The testing program will be conducted in accordance with the procedures outlined in the following sections.

4.0 RULE/COMPLIANCE REQUIREMENTS

The EtO gas-sterilization system at the Willowbrook I facility is being tested to demonstrate compliance with EPA requirements, as specified in the IEPA Air Quality Permit. The following requirements must be met:

- The sterilizer backvent phase emissions must be vented to control equipment with an EtO emission-reduction efficiency of at least 99 % by weight.

Testing is required to demonstrate compliance with these requirements. Source testing of the emission-control system is required initially, and may be required periodically thereafter.

5.0 TEST METHOD REFERENCE

5.1 INTRODUCTION

EtO source testing will be conducted in accordance with the procedures outlined in USEPA CFR40, Part 63.365, using USEPA Method 18 as specified. EtO emissions monitoring will be conducted simultaneously at the inlet and outlet of the Safe Cell System during the entire duration of the backvent phase of one of the four sterilizers. A total of three backvent-phase test runs will be performed.

During the backvent phase, EtO emissions at the inlet and the outlet of the Safe Cell System will be determined using direct source sample injection into a gas chromatograph (GC). All testing will be conducted during normal process load conditions. All backvent testing will be performed with freshly sterilized product in the sterilizer. The testing program will be conducted in accordance with the procedures outlined in the following sections.

Operation and documentation of process conditions will be performed by personnel from Sterigenics, Inc. using existing monitoring instruments installed by the manufacturer on the equipment to be tested. In accordance with the procedures established in USEPA CFR40, Part 63, Subpart O, scrubber liquor level will be recorded.

5.2 VOLUMETRIC FLOW MEASUREMENT

Exhaust gas flow at the outlet of SC2 will be determined by 40 CFR 60, Appendix A, Method 2C, using a standard pitot tube and an inclined-oil manometer. Sampling ports will be located in accordance with 40 CFR 60, Appendix A, Method 1. The test ports will be located far enough from any flow disturbances to permit accurate flow measurement.

Temperature measurements will be obtained from a type K thermocouple and thermometer attached to the sampling probe. Exhaust gas composition will be assumed to be >99% ambient air. Water vapor will be negligible and, based on previous test data, a default ambient value of 3 percent will be used for determination of exhaust gas composition and flow calculations.

5.3 CONTROL EFFICIENCY AND MASS EMISSIONS MEASUREMENT

The EtO concentration at the inlet and outlet of the Safe Cell System will be measured simultaneously following the procedures delineated in USEPA CFR40, Part 63.365. During backvent, vented gas will be analyzed by an SRI, Model 8610, portable gas chromatograph (GC), equipped with the following: dual, heated sample loops and injectors; dual columns; and dual detectors. A flame ionization detector (FID) will be used to quantify emissions at the emission-control device inlet, and a photoionization detector (PID) will be used to quantify emissions at the emission-control device outlet.

5.4 SAMPLE TRANSPORT

Source gas will be pumped to the GC at approximately 500-1000 cubic centimeters per minute (cc/min) from the sampling ports through two lengths of Teflon® sample line, each with a nominal volume of approximately 75 cubic centimeters (cc) and an outer diameter of 0.25 inch. At the outlet of SC2 the sampling ports will be located in the exhaust stack.

5.5 GC INJECTION

Source-gas samples will then be injected into the GC which will be equipped with two heated sampling loops, each containing a volume of approximately 2cc and maintained at 100 degrees Celsius (C). Injections will occur at approximately one-minute intervals during the sterilization chamber backvent phase. Helium will be the carrier gas for both FID and PID.

5.6 GC CONDITIONS

The packed columns for the GC will both be operated at 85 degrees C. The columns will be stainless steel, 6 feet long, 0.125 inch outer diameter, packed with 1 percent SP-1000 on 60/80 mesh Carbopack B.

Any unused sample gas will be vented from the GC system back to the inlet of the scrubber.

5.7 CALIBRATION STANDARDS

The FID used at the inlet will be calibrated for part-per-million-by-volume (ppmv)-level analyses using gas proportions similar to the following:

1) 100 ppmv EtO, balance nitrogen
2) 50 ppmv EtO, balance nitrogen (audit gas)
3) 10 ppmv EtO, balance nitrogen
4) 1 ppmv EtO, balance nitrogen

The PID used at the outlet will be calibrated for ppmv-level analyses using gas proportions similar to the following:

1) 100 ppmv EtO, balance nitrogen
2) 50 ppmv EtO, balance nitrogen (audit gas)
3) 10 ppmv EtO, balance nitrogen
4) 1 ppmv EtO, balance nitrogen

Each of these calibration standards will be in a separate, certified manufacturer's cylinder. Copies of the calibration gas laboratory certificates will be included with the final report.

5.8 SAMPLING DURATION

Backvent EtO measurements will be taken for the entire duration of the backvent phase, which will be 15 minutes. This will encompass a total sampling duration of 15 minutes for each backvent phase test run.

5.9 CONTROL-EFFICIENCY/MASS-EMISSIONS CALCULATIONS

Control efficiency of EtO will be calculated for the backvent phase. Control efficiency will be calculated for each data point which will be produced at each injection interval. The time-weighted-average (TWA) EtO control efficiency will be calculated using these results. Results of the control-efficiency testing will be summarized in the final report.

Mass emissions of EtO will be calculated using the following equation:

MassRate = (VolFlow)(MolWt)(ppmv EtO/10^6)/(MolVol)

Where:

MassRate = EtO mass flow rate, pounds per minute

VolFlow = Corrected volumetric flow rate, standard cubic feet per minute at 68 degrees F

MolWt =	44.05 pounds EtO per pound mole
ppmv EtO =	EtO concentration, parts per million by volume
10^6 =	Conversion factor, ppmv per "cubic foot per cubic foot"
MolVol =	385.32 cubic feet per pound mole at one atmosphere and 68 degrees F

Mass emissions of EtO will be calculated for backvent. The results will be summarized in the final report.

6.0 TEST SCENARIO

Backvent testing will be performed during normal process load conditions, with freshly sterilized product in the sterilizer. Three test runs will be conducted in series to verify the performance of the emission-control system. The testing schedule will be as follows:

- Equipment setup and gas chromatograph calibration.
- Backvent Test Run #1 is performed with freshly sterilized product in one of the four sterilizers. Sampling is performed at the inlet and outlet of the Safe Cell System.
- Backvent Test Run #2 is performed with freshly sterilized product in one of the four sterilizers. Sampling is performed at the inlet and outlet of the Safe Cell System.
- Backvent Test Run #3 is performed with freshly sterilized product in one of the four sterilizers. Sampling is performed at the inlet and outlet of the Safe Cell System.
- Post-calibration check performed and equipment breakdown.

7.0 QA/QC

7.1 FIELD TESTING QUALITY ASSURANCE

At the beginning of the test, the sampling system will be leak checked at a vacuum of 15 inches of mercury. The sampling system will be considered leak free when the flow indicated by the rotameters falls to zero.

At the beginning of the test, a system blank will be analyzed to ensure that the sampling system is free of EtO. Ambient air will be introduced at the end of the heated sampling line and drawn through the sampling system line to the GC for analysis. The resulting chromatogram also will provide a background level for non-EtO components (i.e. ambient air, carbon dioxide, water vapor) which are present in the source gas stream due to the ambient dilution air which is drawn into the emission-control device. This chromatogram, designated AMB, will be included with the calibration data in the final report.

7.2 CALIBRATION PROCEDURES

The GC system will be calibrated at the beginning and conclusion of each day's testing. Using the Peaksimple II analytical software, a point-to-point calibration curve will be constructed for each detector. A gas cylinder of similar composition as the calibration gases, but certified by a separate supplier, will be used to verify calibration gas composition and GC performance.

All calibration gases and support gases used will be of the highest purity and quality available. A copy of the laboratory certification for each calibration gas will be included in the final report.

8.0 FINAL TEST REPORT DESCRIPTION

The test results will be summarized in a written report. This report will be submitted to the IEPA no later than sixty days after the conclusion of the field testing. It will include results for EtO control efficiency of the emission-control device and mass emissions of EtO to the atmosphere from the emission-control device outlet. The report will contain:

- Summary tables with comparisons of the test results to rule limits;
- Copies of all intermediate data tables and calculation worksheets;
- Copies of all GC chromatograms from calibration runs and sample injections; and
- Laboratory calibration certificates for all calibration and audit gases and all applicable measurement instruments such as pitot tubes and thermocouples.

REPORT OF AIR POLLUTION SOURCE TESTING OF AN ETHYLENE OXIDE EMISSION-CONTROL SYSTEM OPERATED BY STERIGENICS, US, LLC IN WILLOWBROOK, ILLINOIS ON SEPTEMBER 21, 2018

WILLOWBROOK I FACILITY

Submitted to:

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY
1021 North Grand Avenue East
Springfield, Illinois 62794

Submitted by:

STERIGENICS US, LLC.
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Oak Brook, Illinois 60523

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Revision 1

OCTOBER 30, 2018

ECSi

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TEST DATE

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LIST OF APPENDICES

1.0 INTRODUCTION

Revision 1 was completed at the request of USEPA and IEPA. Revisions made to the report include:

- Report address changed on page i for General Manager Paul Krett to reflect Willowbrook I facility address.
- Conversion made from wet ppm to dry ppm formula added to Section 5.9.
- Section 8.0 Test Results show efficiency changed from ≥99.6179 to ≥99.6132%.
- Tables 1 and 2: Added columns to show dry ppm conversion values for inlet and outlet concentrations
- Tables 1 and 2: Included moisture/temperature calculation averages for each run.
- Tables 1 and 2: Mass Flow values were previously calculated in lbs./second and labeled lbs./minute. Edit made to show values in lbs./minute.

On Friday, September 21, 2018, ECSi, Inc. performed air pollution source testing of an ethylene oxide (EtO) emission-control device operated by Sterigenics US, LLC at their Willowbrook I ethylene oxide sterilization facility located at 7775 Quincy Street. The control device tested was a two-stage Advanced Air Technologies (AAT) Safe Cell emission-control system, comprised of a packed-tower chemical scrubber and a dry-bed reactor, used to control emissions from fourteen sterilizer backvents, and three aeration rooms.

The purpose of the testing program was to demonstrate compliance with the conditions established in Section 6 of the Construction Permit (Application No: 18060020) granted to Sterigenics by the Illinois Environmental Protection Agency (IEPA) to control emissions from the sterilization chamber backvents. See Appendix L.

Test Protocols were submitted and approved by IEPA prior to testing. Copies of protocols and approval are included with Appendix L.

Representatives from Sterigenics were present during the testing as well as personnel listed below:

- Kevin Mattison, IEPA
- Ned Shappley, US EPA, OAQPS
- Margaret Sieffert, US EPA, Region 5
- Paul Farber, PE (Consultant for Village of Willowbrook)
- Lawrence Link, Tri-State Fire Department

2.0 EQUIPMENT

The gas sterilization and emission control equipment in Willowbrook I consists of the following:

- Fourteen Sterilizers, each comprised of a steam-heated sterilization chamber, a vacuum pump chamber evacuation system, and a backvent valve;
- Three aeration rooms, each comprised of a heated aeration space.

Chamber vacuum pump emissions are controlled by:

- One Chemrox DEOXX packed tower chemical scrubber, equipped with a packed reaction/interface column, a scrubber fluid recirculation system, and a scrubber fluid reaction/storage tank.

Chamber backvents, and aeration emissions are controlled by:

- One two-stage Advanced Air Technologies (AAT) Safe Cell emission-control system, comprised of a packed-tower acid/water scrubber (SC1), equipped with a packed reaction/interface column, a scrubber fluid recirculation system, and a scrubber fluid reaction/storage tank, and a dry bed reactor/scrubber (SC2), comprised of a bank of solid-bed reaction vessels containing Safe-Cell IIA Reactant for EtO control, connected in parallel, installed downstream of SC1 and upstream of a dedicated blower exhaust system designed to operate at 15,500 cfm.

The facility has also been granted permission in its permit to direct chamber vacuum pump emissions to the AAT system. This operating scenario is rarely utilized, and will not be studied in this testing program.

3.0 RULE/COMPLIANCE REQUIREMENTS

The EtO gas-sterilization system at the Willowbrook I facility was tested to demonstrate compliance with requirements specified in the Construction Permit issued by IEPA (Application No: 18060020) and CAAPP Permit No: 043110AAC. The following requirements must be met:

- The existing emission control equipment for chamber exhaust and aeration room emissions is required by 40 CFR Part 63, Subpart O to achieve a control efficiency of 99% or greater.
- Chamber backvent emissions are not regulated through the federal regulations at 40 CFR Part 63, Subpart O. By way of permit application 18060020, Sterigenics has voluntarily elected to control backvent emissions using existing emission control equipment at the facility already required to achieve 99% or greater control efficiency.

Testing is required to demonstrate continued compliance with these requirements.

4.0 TESTING

EtO source testing was conducted in accordance with the procedures outlined in US EPA Reference Methods 2, 3, 4 and 18. EtO emissions monitoring was conducted simultaneously at the inlet and outlet of the AAT System during the 15-minute duration of the backvent process. Three 15-minute test runs were performed.

4.1 TEST SCENARIO

Once a sterilization chamber cycle ends, a sample from inside the chamber is taken and measured to ensure the EtO concentrations are below 25% of the lower explosive limit (LEL) for safety reasons. Current controls interlocks will not allow the doors to be open if the concentration of EtO at the end of a cycle exceeds 25% LEL. Once this criterion has been met, the process requires the chamber door to be partially opened for 15 minutes which vents the EtO in the chamber to reduce levels in the chamber and exposure to employees. The 15-minute duration ensures the highest concentration of EtO is removed from the chamber prior to unloading the product. During this venting, EtO exhausts through the backvent and to the AAT scrubber. In accordance with the facility's procedures, workers are not allowed to enter or unload the chamber until the 15-minute time period has passed. Once the 15-minutes has passed, the product is unloaded to the aeration room.

To meet Condition 6 of the Construction Permit which requires conditions for testing to be conducted as representative of maximum emissions, each test run was completed on the backvents using freshly sterilized product from one chamber for a 15-minute duration, for a total of three test runs at each facility. The emission testing of the sterilization chambers occurred while running FDA validated cycles with higher ending EtO concentrations for testing. Each test interval tested the first 15 minutes the backvent is opened and exhausted to the AAT scrubber.

4.2 PROCESS PARAMETERS MONITORED

Based on the overall AAT scrubber liquor storage volume, relatively short duration of the test, and knowledge of the operation of the AAT system, the properties of the AAT scrubber liquor were not expected to change significantly during the test. Because of this, the AAT Scrubber tank level, pH, and glycol concentration (measured via refractometer) were monitored and recorded before and after the performance of the three trial runs. Results are presented in Appendix A.

Cycle information for each test run, including ending EtO concentration in the chamber space, also was provided. Emission levels from aeration also were recorded before performance of the three test runs. Results are presented in Appendix A.

During routine operations, weekly concentration sampling of the AAT system is conducted using samples collected from the AAT system outlet using a Tedlar bag and the facility's gas chromatograph system. Since this performance testing involved real-time analysis of the inlet and outlet concentrations of the AAT system, Tedlar bag sampling was not conducted during these tests.

4.3 TESTING EQUIPMENT

Testing equipment information and certifications are located in Appendix G.

5.0 TEST METHOD REFERENCE

5.1 INTRODUCTION

EtO source testing was performed in accordance with US EPA Reference Methods 1, 2, 3, 4 and 18. EtO emissions monitoring was conducted simultaneously at the inlet and outlet of the AAT System during each 15-minute duration of the backvent process. A total of three test runs was performed.

During backvent testing, EtO emissions at the inlet and the outlet of the AAT Safe Cell System were determined using direct source sample injection into the gas chromatograph (GC). The GC used to analyze EtO concentrations was a SRI Model 8610 (also described in Section 5.3).

US EPA Method 1: Sample and Velocity Traverses for Stationary Sources (40 CFR 60 Appendix A)

Sample ports and flow traverse locations were located at the inlet and outlet of the AAT control device. Numbers of flow traverse locations were selected to exceed those recommended by Tables 1.1 and 1.2, and were spaced throughout the duct in accordance with Method 1. The average angle of cyclonic flow at each traverse point was less than the maximum average angle specified in Method 1. For further information on sample port locations, sample and velocity traverses, and cyclonic flow measurements please see Appendix B.

US EPA Method 2: Determination of Stack Gas Velocity and Volumetric Flow Rate (Type S Pitot Tube) (40 CFR 60 Appendix A).

The average gas velocity in a stack is determined from the gas density and from measurement of the average velocity head with a Type S (Stausscheibe or reverse type) Pitot tube. This method was used in its entirety as per the procedures outlined in Method 2.

ESCI performed a cyclonic flow check and velocity traverse using an S-type Pitot tube in each duct prior to the first test run. These results were used to calculate EtO mass flow rates. ESCI also used a standard Pitot tube constructed in accordance with Method 2C to measure velocity at a single point in the duct during the test runs to verify that gas flow rate remained steady during tests.

US EPA Method 3: Gas Analysis for the Determination of Dry Molecular Weight (40 CFR 60 Appendix A)

The Construction permit at 6(b) specifies testing using Method 3A or 3B (for calculating the dry molecular weight of the duct gases based on measurement of the duct gas oxygen and carbon dioxide concentrations). In accordance with Method 2, Section 8.6 and the approved Test Protocol, a dry molecular weight of 29.0 was assumed instead of by calculation. This is in accordance with Method 2 and is allowed by Method 3 because the process does not involve combustion and emits essentially ambient air.

US EPA Method 4: Determination of Moisture Content in Stack Gases (40 CFR 60 Appendix A)

The moisture concentrations in the duct gases were calculated assuming saturated conditions based on the measured gas temperature, duct static pressure and barometric pressure, in accordance with Method 4(16.4). For calculations pertaining to this method, see Appendix D.

- Barometric pressure was determined using local meteorological data from the time and date of the actual testing. See Appendix F.

- Duct static pressure was determined using an inclined oil manometer.

- Duct gas temperature was determined using from a type K thermocouple and thermometer.

US EPA Method 18: Measurement of Gaseous Organic Compound Emissions by Gas Chromatography

The major organic component of the gas mixture, EtO is separated by gas chromatography (GC). Measurement of EtO concentrations across the inlet/outlet ducts are expected to be uniform due to extensive air mixing throughout the emission control system. During backvent operations, constituents of the streams entering and exiting the AAT System were analyzed at a single point by an SRI, Model 8610, portable GC, equipped with the following: dual, heated sample loops and injectors; dual columns; and dual detectors. A flame ionization detector (FID) was used to quantify inlet EtO emissions, and photoionization detector (PID) was used to quantify low-level EtO emissions at the emission control system outlet. The PID was equipped with a 11.7eV lamp. For chromatographic data associated with the use of this method, see Appendix E. The sample transport system is described in Section 5.4 of this report.

Samples were continuously extracted and analyzed at approximately one- to two-minute intervals, for a total of 12 to 13 samples, during each 15-minute test run.

5.2 VOLUMETRIC FLOW MEASUREMENT

Exhaust gas flow at the inlet and outlet of the AAT scrubber was determined by Method 2, using an S-type pitot tube and an inclined-oil manometer. Sampling ports were located in accordance with Method 1. The test ports were located far enough from any flow disturbances and velocity was measured at multiple points within the duct cross-section to permit accurate flow measurement. Equal-area traverse points for pre-test velocity traverses were selected in accordance with Method 1. Confirmation of the absence of cyclonic flow occurred prior to the commencement of the three test runs. Please see Appendices B and F for additional Method 1 related information.

Because of the short duration of the backvent operation, traversing the entire stack during each minute of test run was infeasible. With approval of IEPA and US EPA, an average differential pressure point was determined before the test, and that parameter was used to confirm flow during each minute while concentration samples were collected. Please see Appendix F for tables of this information collected in the field.

Temperature measurements were obtained from a type K thermocouple (FLIR EA10) and thermometer attached to the sampling probe. Exhaust gas composition was assumed to be air saturated with water vapor.

5.3 CONTROL EFFICIENCY AND MASS EMISSIONS MEASUREMENT

During backvent operations, constituents of the streams entering and exiting the AAT System were analyzed by an SRI, Model 8610, portable gas chromatograph (GC), equipped with the following: dual, heated sample loops and injectors; dual columns; and dual detectors. A flame ionization detector (FID) was used to quantify inlet EtO emissions, and photoionization detector (PID) was used to quantify low-level EtO emissions at the emission control system outlet. The PID was equipped with an 11.7eV lamp. The mass of EtO in the inlet and outlet streams were determined using equation shown below in Section 5.9. EtO mass control efficiency during the backvent process was calculated by comparing the mass of EtO vented to the system inlet to the mass of EtO vented from the system outlet. See equation shown in Section 5.9.

5.4 SAMPLE TRANSPORT

The Willowbrook I facility utilizes a dual stage AAT system equipped with a 15,500 cfm rated blower system that serves to quickly draw process emissions from the sources through the control system. The AAT Scrubber system efficiency operates at a very high level in large part due to the use of sulfuric acid in the scrubber liquor, which lowers the pH of the solution and acts as a catalyst - increasing the speed of the hydrolysis of ethylene oxide to ethylene glycol.

The gas sample was continuously pumped to the GC at approximately 1000 cubic centimeters per minute (cc/min) from the sample probe through two 100-foot lengths of heated and insulated 3/8" Teflon® sample line (.030 wall), each with an interior volume of approximately 1535 cubic centimeters. The source gas was pumped to the GC with a response time of approximately 1.5 seconds. See Appendix H for sample line volume and residence time calculations.

The lines were heated to $\geq$ 110 °C. Temperature of the heated lines was monitored before, during and after each trial run via observing the temperature on the heated lines temperature controller. See Appendix A for this data. The sample probe was constructed of stainless steel tubing and was not heated.

At the inlet of the Safe Cell System, the sampling ports were located in the duct immediately upstream of the packed tower scrubber. At the outlet of the AAT System, sampling ports were located in the exhaust stack downstream of the dry bed reactors. See Appendix B for sampling port location information.

5.5 GC INJECTION

Source-gas samples were then injected into the GC which was equipped with two heated sampling loops, each containing a volume of approximately 2 cubic centimeters (cc) and maintained at 100 degrees Celsius (°C). Injections occurred at approximately one to two-minute intervals during backvent testing. Helium was the carrier gas for both the FID and the PID.

5.6 GC CONDITIONS

The packed columns for the GC were both operated at 90 °C. The columns were stainless steel, 6 feet long, 0.125 inch outer diameter, packed with 1 percent SP-1000 on 60/80 mesh Carbopack B.

During the analysis, the FID was operated at 250 °C. The support gases for the FID were hydrogen (99.995% pure) and air (99.9999% pure). Any unused sample gas was vented from the GC system back to the inlet of the control device being tested.

5.7 CALIBRATION STANDARDS

The FID was calibrated for mid-range part-per-million-by-volume (ppmv) level analysis using gas proportions similar to the following:

1) 1000 ppmv EtO, balance nitrogen ***
2) 100 ppmv EtO, balance nitrogen
3) 50 ppmv EtO, balance nitrogen (audit gas)
4) 10 ppmv EtO, balance nitrogen
5) 1 ppmv EtO, balance nitrogen

***Note: Calibrations for this standard were performed following the test to confirm appropriate range of instrument.

The PID was calibrated for low-range ppmv level analyses using gas proportions similar to the following:

1) 100 ppmv EtO, balance nitrogen
2) 50 ppmv EtO, balance nitrogen (audit gas)
3) 10 ppmv EtO, balance nitrogen
4) 1 ppmv EtO, balance nitrogen

See Appendix J for calibration gas certifications. Please see Appendix I for triplicate calibration data performed before and after each set of test runs and calibration curves.

As a part of the test's quality assurance, limit of detection and recovery studies were performed. Refer to that section later in the document and Appendices K and I, respectively for further information.

5.8 SAMPLING DURATION

Testing was performed in 15-minute increments in conjunction with normal production operations, for each of the three test runs while chamber backvents were operating.

5.9 SAMPLE CALCULATIONS

Method 1

Equivalent diameter was calculated as follows:

$$D_e = \frac{2(L)(W)}{L+W}$$

Actual diameters of round ducts and equivalent diameters of square and rectangular ducts were used to evaluate whether sufficient distance existed between the sample ports and upstream and downstream flow disturbances. These figures were used in conjunction with Method 1's Table 1.1 and 1.2 to ensure that the minimum number of traverse points required for testing was exceeded.

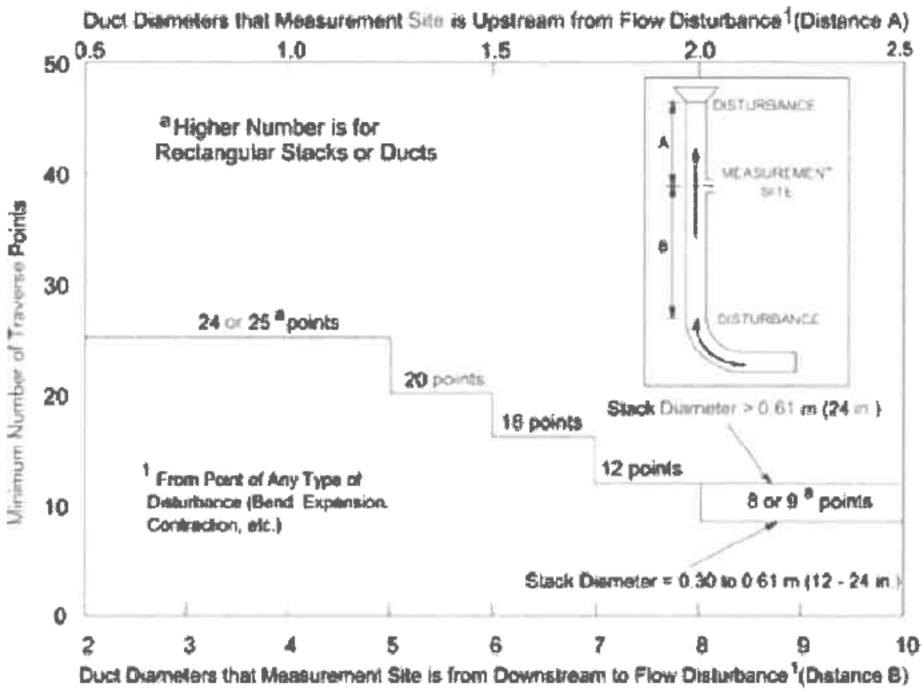

Figure 1-1. Minimum number of traverse points for particulate traverses

* * * * *

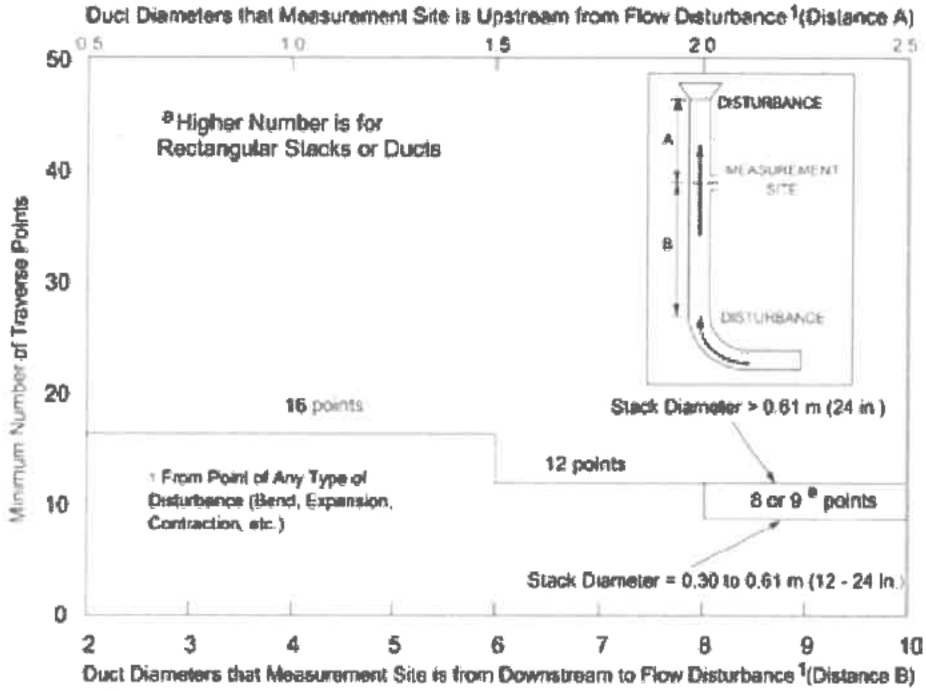

Figure 1-2. Minimum number of traverse points for velocity (nonparticulate) traverses

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Method 2

Stack gas velocity and volumetric flow rate were calculated using equation 2-7 and 2-8 as outlined in Method 2.

Q = Average Stack Gas Dry Volumetric Flow Rate (dscf/min)

$$= 60\,(1 - B_{ws})\,V_s\,A \left| \frac{T_{std}\,P_s}{T_{s(abavg)}P_{std}} \right|$$

V_s = Average Stack Gas Velocity

$$V_s = K_p\,C_p \left[\frac{\sum_{i=1}^{n} \sqrt{\Delta p_i}}{n} \right] \sqrt{\frac{T_{s(abavg)}}{P_s\,M_s}}$$

Where:

K_p = Velocity equation constant

$$= \quad 85.49 \frac{ft}{\sec} \left[\frac{(lb/lb-mole)(in.\,Hg)}{(^{o}R)(in.\,H_2O)} \right]^{1/2}$$

C_p = Pitot Tube Coefficient = 0.84 (S-type pitot tube coefficient for geometric calibration)

Δp_i = Individual velocity head reading at traverse point "i" (in. Hg)

n = number of traverse points

$T_{s(abavg)}$ = Average absolute stack temperature (°R)

P_s = Absolute stack pressure (P_{bar} + P_g)

P_{bar} = Barometric pressure at measurement site (in. Hg)

P_g = Stack static pressure (in. Hg)

M_s = Molecular weight of stack gas, wet basis

$$M_s = M_d\,(1 - B_{ws}) + 18.0B_{ws}$$

Method 4

Moisture content was determined using the calculation for saturation in accordance with Method 4.

$$B_{ws(svp)}(\%) = 100\left(\frac{10^{\left(6.691-\left(\frac{3144}{T_{s\,(avg)}+390.86}\right)\right)}}{\left(P_b + \frac{P_{static}}{13.6}\right)}\right)$$

Where:

$B_{ws(svp)}(\%)$ = Saturated moisture concentration (% by volume)

$T_{s(abavg)}$ = Average absolute stack temperature (°F)

P_b = Barometric pressure at measurement site (in. Hg)

P_{static} = Stack static pressure (in. H_20)

Mass Emission Calculation

Mass emissions of EtO during backvent were calculated using the following equation:

W = $(Q)(MolWt)(C/10^6)/(MolVol)$

Where:

W	=	EtO mass flow rate, pounds per minute
Q	=	Corrected duct gas volumetric flow rate, dry standard cubic feet per minute at 68 degrees F and 29.92 in. Hg (see calculation under Method 2)
MolWt	=	44.05 pounds EtO per pound mole
C	=	EtO concentration, parts per million by volume
10^6	=	Conversion factor, ppmv per "cubic foot per cubic foot"
MolVol	=	385.32 cubic feet per pound mole at 68 degrees F and 29.92 in. Hg

Control Efficiency Calculation

Mass control efficiency of EtO during backvent was calculated using the following equation:

Efficiency = $(W_i - W_o / W_i)(100)$

Where:

W_i = Mass flow rate to the control device inlet, pounds per minute, calculated as described above where:

C_i = EtO concentration at the control device inlet, ppm

Q_i = Duct gas volumetric flow rate at the control device inlet, dry standard cubic feet per minute

W_o = Mass flow rate from the control device outlet, pounds per minute calculated as described above where:

C_o = EtO concentration at the control device outlet

Q_o = Duct gas volumetric flow rate at the control device outlet, dry standard cubic feet per minute

Correction to Dry Basis

Dry basis concentration = (wet basis concentration) / (1-w)

where:

w = fraction of emitted exhaust gas, by volume, which is water vapor.

Results of the control-efficiency testing are presented in Section 8.0 and in Table 1 and 2.

6.0 TEST SCENARIO

Backvent testing was performed during normal process load conditions, with freshly sterilized product in the sterilization chambers. Three test runs were conducted in series to verify the performance of the emission-control system.

Sterigenics scheduled three chambers to end the sterilization cycle to allow for the three test runs to run consecutively. The general testing sequence was as follows:

Timing	Task	Method
Prior to test	Sample locations established	Method 1
Prior to test	Sample traverse locations established	Method 1
One time prior to each set of runs	3-point calibration performed in triplicate.	Method 18
One time prior to each set of runs	Confirm absence of cyclonic flow	Method 1
One time prior to each set of runs	Collect AAT system scrubber liquor pH, tank level, and glycol % information. Note levels present from aeration.	N/A
One time prior to each set of runs	Flow traverse of inlet and outlet conducted to establish flow rate and measurement centroid	Method 2
Prior to each test run	Note temperature reading of heated lines	N/A
Over test duration	Chamber door opened approximately 12 inches, actuator switch activates backvent	N/A
Beginning of each run	First sample initiated	Method 18
Over test duration	Samples at inlet and outlet taken approximately every 1-minute for a total of 15-minutes	Method 18
Over test duration	Flow monitoring sampled approximately every 1-minute.	Method 2
Mid-Test	Note temperature reading of heated lines	Method 18
After each test run	Collect cycle number and ending backvent EtO concentration in chamber head space are noted	N/A
After each test run	Note temperature reading of heated lines	Method 18
After each test run	Conduct recovery study	Method 18
After conclusion of each set of test runs	Perform post calibration checks	Method 18
After conclusion of each set of test runs	Collect AAT system scrubber liquor pH, tank level, and glycol %.	N/A
One time following each set of runs	Obtain meteorological data for sampling time	N/A
At least once during two test days for WB I and WB II	Perform Limit of Detection Study	Method 18

7.0 QA/QC

7.1 FIELD TESTING QUALITY ASSURANCE

At the beginning of the test, the sampling system was leak checked at a vacuum of 15 inches of mercury. The sampling system was considered leak free when the flow indicated by the rotameters fell to zero.

At the beginning of the test, a system blank was analyzed to ensure that the sampling system was free of EtO. Ambient air was introduced at the end of the heated sampling line and drawn through the sampling system line to the GC for analysis. The resulting chromatogram also provided a background level for non-EtO components (i.e. ambient air, carbon dioxide, water vapor) which are present in the source gas stream due to the ambient dilution air which is drawn into the emission-control device, and due to the destruction of EtO by the emission-control device which produces carbon dioxide and water vapor. This chromatogram, designated ambient background, is included with the calibration data in Appendix I.

A recovery study was also performed in accordance with Section 8.4.1 of Method 18 using 10 ppm and 100 ppm EtO calibration gas. The 100 ppm calibration gas was drawn through the heated sample line used at the control device inlet, and the 10 ppm calibration gas was drawn through the heated sample line used at the control device outlet. The calibration procedure was repeated in this manner, and it was verified that the analyzer response was within 10% of the calibration gas concentration sampled. See calibration data in Appendix I for further information regarding the recovery study.

7.2 CALIBRATION PROCEDURES

The GC system was calibrated at the beginning and conclusion of each day's testing. Using the Peaksimple II analytical software, a calibration curve was constructed for each detector. Calibration data can be found in Appendix I.

A seven-point Method Detection Limit (MDL) or Limit of Detection (LOD) study was performed prior to testing using procedures described in Section 15.0 of US EPA Method 301 (40 CFR 63 Appendix A) and in 40 CFR 136 Appendix B. The study was recommended by OAQPS and accepted by IEPA. The LOD for this test was determined to be 0.10 ppm. A recovery study was also performed in accordance with Section 8.4.1 of Method 18 using 10 ppm and 100 ppm EtO calibration gas. The 100 ppm calibration gas was drawn through the heated sample line used at the control device inlet, and the 10 ppm calibration gas was drawn through the heated sample line used at the control device outlet. The calibration procedure was repeated in this manner, and it was verified that the analyzer response was within 10% of the calibration gas concentration sampled. Results of the LOD study are presented in Appendix K. Results of the recovery study are presented in Appendix I.

All calibration gases and support gases used were of the highest purity and quality available. A copy of the laboratory certification for each calibration gas is attached as Appendix J.

8.0 TEST RESULTS

The AAT Safe Cell System demonstrated an EtO control efficiency of greater than 99.61 percent. In accordance with various state and federal requirements, this control equipment must have an EtO control efficiency of 99 percent or more. The AAT Safe Cell System has met this requirement.

The test results are summarized in Tables 1 and 2. These tables include results for EtO control efficiency of the emission-control device. Sample calculations related to destruction efficiency and other calculations can be found in Section 5.9.

TABLES 1 AND 2

TABLE 1
ETHYLENE OXIDE CONTROL EFFICIENCY SUMMARY – BACKVENT
FOR STERIGENICS - WILLOWBROOK, ILLINOIS (PLANT 1)
ON SEPTEMBER 21, 2018

Test Run	Inlet Average Concentration (ppm)	Inlet Average Mass Flow rate (lb/min)	Outlet Average Concentration (ppm)[1]	Outlet Average Mass Flow rate (lb/min) ≤	Control Efficiency ≥
1	70.86	0.07984	ND	0.00012	99.6192%
2	30.21	0.03401	ND	0.00012	99.6410%
3	25.40	0.02853	ND	0.00012	99.5795%

Control Efficiency ≥ **99.6132%**

Efficiency = (MassFlowin - MassFlowout / MassFlowin)(100)
Mass Flow (lb/min) = (VolFlow)(MolWt)(C /10$^{6)}$/(MolVol)

MW EtO = 44.05
MolVol = 385.32
C = Dry Concentration

[1] ND = Non Detect. Detection limit of the GC was determined to be 0.10 ppm.

	INLET		OUTLET	
	Average Temperature (°F)	**Moisture Content (%)**	**Average Temperature (°F)**	**Moisture Content (%)**
Run 1	103.8	7.4862	103.8	7.4767
Run 2	104.1	7.5373	104.1	7.5277
Run3	104.9	7.7264	104.9	7.7166

TABLE 2 - ETHYLENE OXIDE CONTROL EFFICIENCY – BACKVENT FOR STERIGENICS - WILLOWBROOK, ILLINOIS (PLANT 1) ON SEPTEMBER 21, 2018

		INLET ETO					OUTLET ETO			
Run #	Time	Wet Concentration (PPM)[1]	Dry Concentration (PPM)[1]	Dry Volumetric Flow	Mass Flow[3] (lb/min)	Wet Concentration (PPM)[1,2]	Dry Concentration (PPM)[1,2]	Dry Volumetric Flow	Mass Flow[3] (lb/min) ≤	Control Efficiency[4] ≥
1	914	11.5	12.43058	9856.0	0.01401	ND	ND	9667.3	0.0001194	99.1472%
1	915	542	585.85843	9856.0	0.66011	ND	ND	9667.3	0.0001194	99.9819%
1	916	38.9	42.04777	9856.0	0.04738	ND	ND	9667.3	0.0001194	99.7479%
1	917	34.5	37.29173	9856.0	0.04202	ND	ND	9667.3	0.0001194	99.7157%
1	918	27.6	29.83338	9856.0	0.03361	ND	ND	9667.3	0.0001194	99.6447%
1	919	26.8	28.96865	9856.0	0.03264	ND	ND	9667.3	0.0001194	99.6340%
1	920	27	29.18483	9856.0	0.03288	ND	ND	9667.3	0.0001194	99.6368%
1	921	23.1	24.96924	9856.0	0.02813	ND	ND	9667.3	0.0001194	99.5754%
1	923	26.4	28.53628	9856.0	0.03215	ND	ND	9667.3	0.0001194	99.6285%
1	924	24	25.94207	9856.0	0.02923	ND	ND	9667.3	0.0001194	99.5914%
1	925	23.7	25.61779	9856.0	0.02886	ND	ND	9667.3	0.0001194	99.5862%
1	926	23.5	25.40161	9856.0	0.02862	ND	ND	9667.3	0.0001194	99.5827%
1	927	23.2	25.07733	9856.0	0.02826	ND	ND	9667.3	0.0001194	99.5773%
2	931	24	25.95640	9849.5	0.02923	ND	ND	9661.0	0.0001194	99.5914%
2	932	22.5	24.33413	9849.5	0.02740	ND	ND	9661.0	0.0001194	99.5641%
2	933	42.3	45.74816	9849.5	0.05151	ND	ND	9661.0	0.0001194	99.7681%
2	934	31.3	33.85148	9849.5	0.03812	ND	ND	9661.0	0.0001194	99.6867%
2	935	28.8	31.14768	9849.5	0.03507	ND	ND	9661.0	0.0001194	99.6595%
2	936	28.7	31.03953	9849.5	0.03495	ND	ND	9661.0	0.0001194	99.6583%
2	937	28.5	30.82323	9849.5	0.03471	ND	ND	9661.0	0.0001194	99.6559%
2	939	26.7	28.87650	9849.5	0.03252	ND	ND	9661.0	0.0001194	99.6327%
2	940	26.8	28.98465	9849.5	0.03264	ND	ND	9661.0	0.0001194	99.6340%
2	941	26.4	28.55204	9849.5	0.03215	ND	ND	9661.0	0.0001194	99.6285%
2	942	26.9	29.09280	9849.5	0.03276	ND	ND	9661.0	0.0001194	99.6354%
2	943	25	27.03792	9849.5	0.03044	ND	ND	9661.0	0.0001194	99.6077%
2	944	25.2	27.25422	9849.5	0.03069	ND	ND	9661.0	0.0001194	99.6108%
3	953	23.1	25.03424	9825.7	0.02812	ND	ND	9637.6	0.0001194	99.5754%
3	954	22.8	24.70912	9825.7	0.02776	ND	ND	9637.6	0.0001194	99.5698%
3	955	27.8	30.12779	9825.7	0.03384	ND	ND	9637.6	0.0001194	99.6472%
3	956	26	28.17707	9825.7	0.03165	ND	ND	9637.6	0.0001194	99.6228%
3	957	23.8	25.79286	9825.7	0.02897	ND	ND	9637.6	0.0001194	99.5879%
3	958	23	24.92587	9825.7	0.02800	ND	ND	9637.6	0.0001194	99.5736%
3	1000	22.3	24.16726	9825.7	0.02715	ND	ND	9637.6	0.0001194	99.5602%
3	1001	22.8	24.70912	9825.7	0.02776	ND	ND	9637.6	0.0001194	99.5698%
3	1002	22.8	24.70912	9825.7	0.02776	ND	ND	9637.6	0.0001194	99.5698%
3	1003	23.4	25.35936	9825.7	0.02849	ND	ND	9637.6	0.0001194	99.5809%
3	1004	21.7	23.51702	9825.7	0.02642	ND	ND	9637.6	0.0001194	99.5480%
3	1006	21.7	23.51702	9825.7	0.02642	ND	ND	9637.6	0.0001194	99.5480%

Notes

[1] PPM = parts per million by volume

[2] ND = Non Detect. Detection limit of the GC was determined to be 0.10 ppm.

[3] See Table 1 for Mass Flow Calculation

[4] See Table 1 for Control efficiency calculation

fficiency = (MassFlowin - MassFlowout / MassFlowin)(100)

' (lb/min) = (VolFlow)(MolWt)(C /10$^{6)}$/(MolVol)

MW EtO = 44.05

MolVol = 385.32

APPENDICES

ECSi

APPENDIX A

Process Parameter Logs

PROCESS PARAMETER LOG FOR EACH TRIAL

DATE: 21 SEP 2018

SITE AAT TESTED (circle one) Willowbrook I Willowbrook II

Chamber Backvent Tested:	A	
Chamber Running Cycle Number:	183 6 pallet chamber - w/6 pallets	
Parameter	START (Data and Time)	FINISH (Data and Time)
Backvent Opening Time	9:12 AM	9:27 AM
Levels From Aeration	11 ppm 9:09 am 10.9 ppm 9:10 am	not recorded
Ending Chamber EO Concentration	7020 ppm EO	

	Beginning (Time)	Middle (Time)	End (Time)
Heated Lines Temp Check Include Temp Units	230 F / 230 F	230 F / 230 F	230 F / 230 F
	9:10 am	9:17 am	9:27 am

PROCESS PARAMETER LOG FOR EACH TRIAL

DATE: 21 SEP 2018

SITE AAT TESTED (circle one): Willowbrook I Willowbrook II

Chamber Backvent Tested:	3 6 pallet chamber w/6 pallets	
Chamber Running Cycle Number:	169	
Parameter	**START (Data and Time)**	**FINISH (Data and Time)**
Backvent Opening Time	9:30am	9:45 am
Levels From Aeration	not recorded	not recorded
Ending Chamber EO Concentration	2760 ppm EO	

	Beginning (Time)	Middle (Time)	End (Time)
Heated Lines Temp Check Include Temp Units	230F/230F	230F/230F	230F/230F
	9:36 AM	9:40 AM	9:45 am

PROCESS PARAMETER LOG FOR EACH TRIAL

DATE: 21 SEP 2018

SITE AAT TESTED (circle one): Willowbrook I Willowbrook II

Chamber Backvent Tested:	10 13 pallet chamber w/ 12 pallets	
Chamber Running Cycle Number:	510	
Parameter	**START (Data and Time)**	**FINISH (Data and Time)**
Backvent Opening Time	9:52am	10:07am
Levels From Aeration	not recorded	not recorded
Ending Chamber EO Concentration	0 ppm EO	

	Beginning (Time)	Middle (Time)	End (Time)
Heated Lines Temp Check Include Temp Units	230F /230F	230F / 230F	230F/ 230 F
	9:55 AM	9:59 AM	10:07 AM

PROCESS PARAMETER LOG FOR EACH SET OF TRIALS

Circle One: Willowbrook 1 AAT Willowbrook 2 AAT

Parameter	BEFORE (Time)	AFTER (Time)
AAT Tank Level (inches)	151" 8:12 AM	144" 10:20 AM
AAT Liquor pH	0.87 8:12 AM	0.87 10:20 AM
AAT Liquor Glycol %	36.2% 8:12 AM	36.4 10:20 AM

Samples collected by: NICK ZIELINSKI

Signature:

DATE: 21 SEP 2018

PLEASE ATTACH TODAY'S METEOROLOGICAL DATA TO THESE TEST RECORDS

APPENDIX B

Method 1 Calculation

ECSi

WB Sample Port Locations	Duct Size/Configuration	Length (Diameter)	Width	Diameter (Eq. Diameter)		Distance from/to Disturbance	Diameters from/to Disturbance	2D or greater downstream?	0.5D or greater upstream?
WB I Inlet	36" round	36		36	Downstream	78	2.2	YES	
				36	Upstream	44	1.2		YES
WB I Outlet	30" x 20" rectangular	30	20	24	Downstream	60	2.5	YES	
				24	Upstream	84	3.5		YES
WB II Inlet	28" round	28		28	Downstream	108	3.9	YES	
				28	Upstream	96	3.4		YES
WB II Outlet	28" square	28	28	28	Downstream	56	2.0	YES	
				28	Upstream	170	6.1		YES

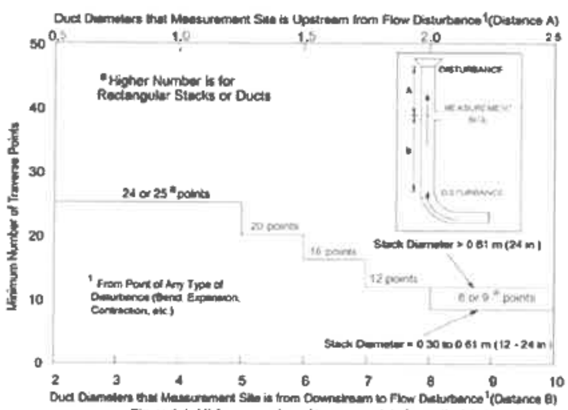


Figure 1-1. Minimum number of traverse points for particulate traverses

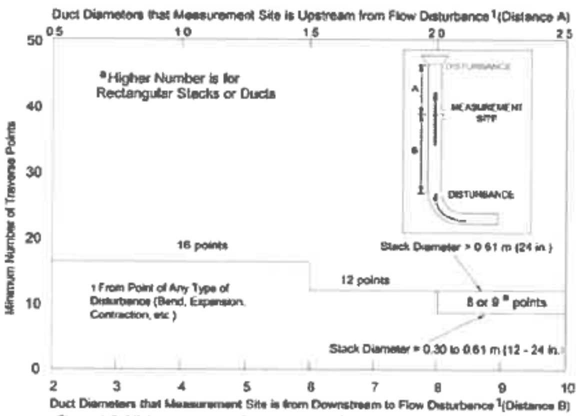


Figure 1-2. Minimum number of traverse points for velocity (nonparticulate) traverses

$$D_e = \frac{2(L)(W)}{L+W}$$

Willowbrook 1 AAT Inlet Duct Sampling Location

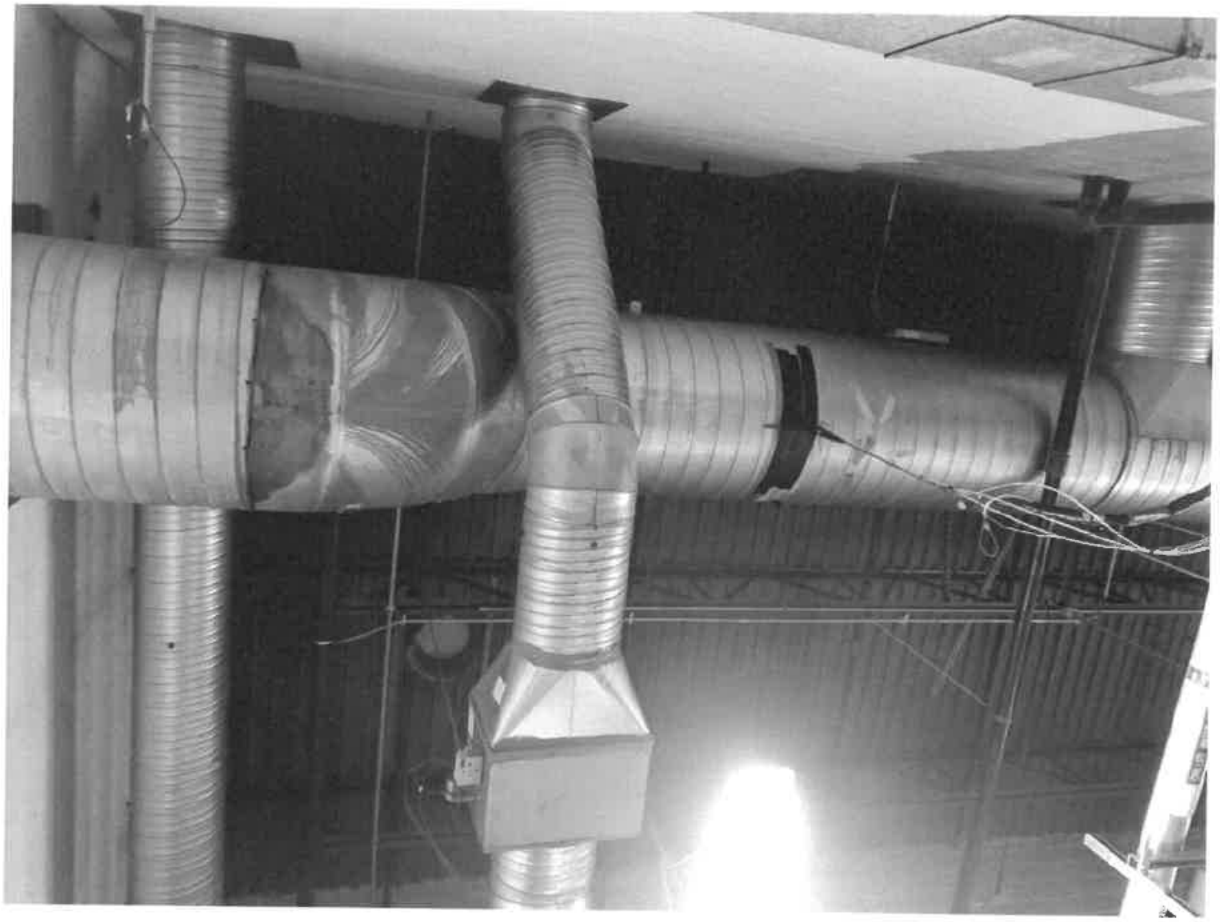


Photo Description – Photo taken in WB1 Chamber C Room, looking towards roof near room entrance. North and AAT control device is to the left.

Willowbrook I Inlet Duct Sampling Duct Location Diagram

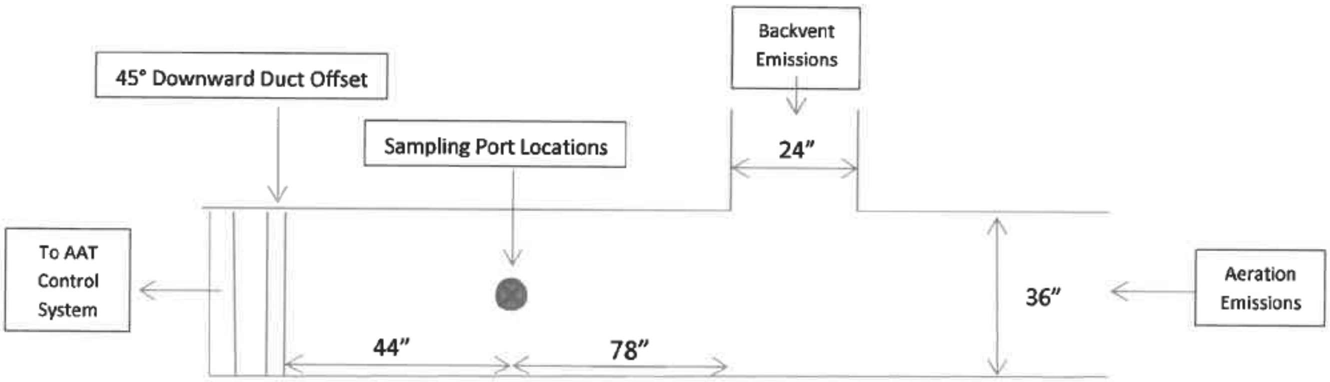


Diagram Description – Diagram depicts inlet duct configuration seen in photo, looking towards roof. All ducts are circular, with given diameters. 44" and 78" are measurements to nearest disturbances in the duct from sample port location.

Sampling port depicted is facing Chamber C Room floor. An additional port will be located on the duct 90° from depicted port.

Willowbrook 1 AAT Outlet Duct Sampling Location

Photo Description – Photo taken in WB1 AAT Drybed Room, looking Southeast. Duct is rectangular until it transitions near the roofline.

Willowbrook I Outlet Sampling Duct Location Diagram

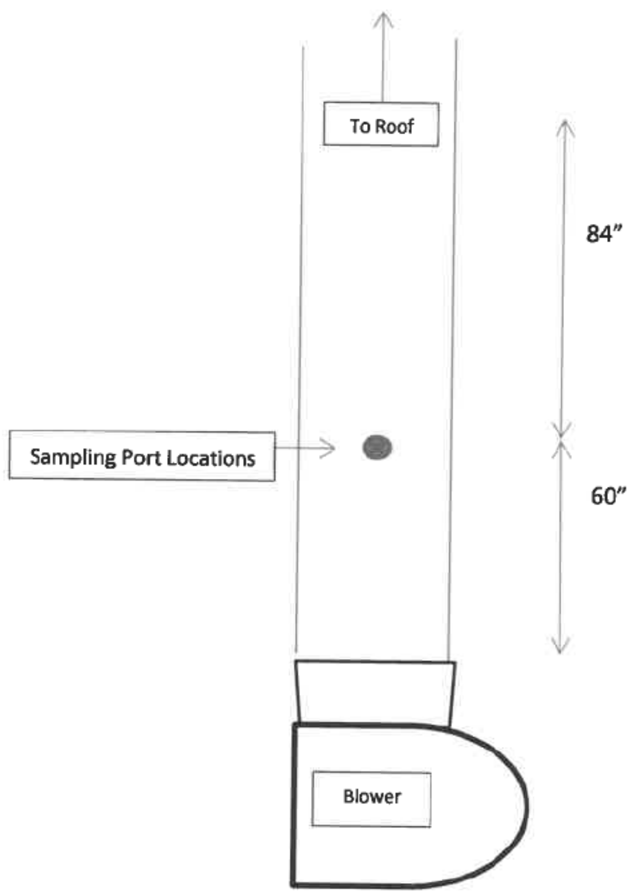


Diagram Description – Diagram depicts outlet duct sampling configuration in AAT Drybed Room seen in photo, with a slightly more perpendicular view to the duct, towards the south. The main run of ducting where the samples will be obtained is a 30" x 20" rectangular duct. 84" and 60" are measurements to nearest duct disturbances.

APPENDIX C

Method 2 Calculation

ECSi, Inc.

Volumetric Flow Calculation - AAT Inlet

Sterigenics US, LLC - Willowbrook, IL (Plant 1)
9/20/2018

Data from Traverse Table

Average SQRT(Δp)	0.4644	from Traverse Table
Temp	103.0	°F
	563	°R
Moisture Content	7.30%	
Ms	28.20	molecular weight of stack gas
Pb	28.95	Barometric pressure (in Hg)
Pg	-0.25	Stack static pressure (in H2O)
Ps	28.932	Absolute stack pressure

Constants

MW dry =	29.00	
stack diameter =	36	in.
stack area =	7.07	sq. ft.
Tstd =	528	
Pstd =	29.92	
Cp =	0.84	
Kp =	85.49	

Stack Velocity (Vs) = 27.7 ft/sec

$$V_s = K_p\ C_p \left[\frac{\sum_{i=1}^{n} \sqrt{\Delta\ p_i}}{n} \right] \sqrt{\frac{T_{s\,(abavg)}}{P_s\ M_s}}$$

Stack Flow (inlet)= **11749** **acf/min**

$Q_{actual} = 60 * V_s * A_s$

Stack Flow (inlet) = **9877** **dscfm**

$$Q = 60\,(1 - B_{ws})\,V_s\,A \left| \frac{T_{std} P_s}{T_{s(abavg)} P_{std}} \right|$$

ECSi, Inc.

Volumetric Flow Calculation - AAT Outlet

Sterigenics, Inc. - Willowbrook, IL (Plant 1)
9/20/2018

Data from Traverse Table			**Constants**		
Average SQRT(Δp)	0.7718	from Traverse Table	**MW dry =**	29.00	
Temp	107.3	°F	**stack dimensions =**	20x30	in.
	567	°R	**stack area =**	4.17	sq. ft.
			Tstd =	528	
			Pstd =	29.92	
Moisture Content	8.20%		**Cp =**	0.84	
Ms	28.10	molecular weight of stack gas	**Kp =**	85.49	
Pb	28.95	Barometric pressure			
Pg	0.25	Stack static pressure			
Ps	28.97	Absolute stack pressure			

Stack Velocity (Vs) = 46.3 ft/sec

$$V_s = K_p\, C_p \left[\frac{\sum_{i=1}^{n} \sqrt{\Delta p_i}}{n} \right] \sqrt{\frac{T_{s\,(abavg)}}{P_s\ M_s}}$$

Stack Flow (outlet)= 11568 acf/min

$Q_{actual} = 60 * V_s * A_s$

Stack Flow (outlet) = 9570 dscfm

$$Q = 60\,(1 - B_{ws})\, V_s\, A \left| \frac{T_{std} P_s}{T_{s(abavg)} P_{std}} \right|$$

ECSI, INC. - VELOCITY TRAVERSE DATA

Client: Sterigenics
Location: Willowbrook - Plant 1
Source: AAT Safe Cell System Inlet

Run #: 1　Date: 9/21/2018　Port Sketch:
Probe Type: S　Baro Press: 28.95
Stack I.D.: 36 in.

	Port 1							Port 2						
Inches		Delta P				Stack	Cyclonic		Delta P				Stack	Cyclonic
From Port	Point#	Low	High	Average	Sq Root	Temp (F)	Angle	Point#	Low	High	Average	Sq Root	Temp (F)	Angle
0.7	1	0.25	0.25	0.25	0.5000	101	1.5	1	0.21	0.21	0.21	0.4583	103	5.0
2.4	2	0.15	0.15	0.15	0.3873	101	5.6	2	0.22	0.22	0.22	0.4690	103	4.6
4.2	3	0.18	0.18	0.18	0.4243	102	2.0	3	0.21	0.21	0.21	0.4583	103	3.6
6.3	4	0.2	0.2	0.2	0.4472	102	1.8	4	0.25	0.25	0.25	0.5000	103	5.1
9.0	5	0.21	0.21	0.21	0.4583	102	1.0	5	0.23	0.23	0.23	0.4796	103	3.0
12.9	6	0.25	0.25	0.25	0.5000	103	0.5	6	0.25	0.25	0.25	0.5000	103	2.6
23.1	7	0.21	0.21	0.21	0.4583	104	1.0	7	0.16	0.16	0.16	0.4000	103	8.8
27.0	8	0.23	0.23	0.23	0.4796	104	1.4	8	0.19	0.19	0.19	0.4359	103	6.3
29.7	9	0.19	0.25	0.22	0.4690	104	2.4	9	0.24	0.24	0.24	0.4899	103	4.1
31.8	10	0.19	0.19	0.19	0.4359	104	0.5	10	0.22	0.22	0.22	0.4690	103	2.2
33.6	11	0.26	0.26	0.26	0.5099	105	1.5	11	0.26	0.26	0.26	0.5099	102	2.8
35.3	12	0.19	0.19	0.19	0.4359	105	1.8	12	0.22	0.22	0.22	0.4690	103	2.1
	13							13						
	14							14						
	15							15						
	16							16						
	17							17						
	18							18						
	19							19						
	20							20						
	21							21						
	22							22						
	23							23						
	24							24						
										Average Values:	0.2167	0.4644	103.0	3.0

ECSI, INC. - VELOCITY TRAVERSE DATA

Client: Sterigenics
Location: Willowbrook - Plant 1
Source: AAT Safe Cell System Outlet

Run #: 1 | Date: 9/21/2018 | Port Sketch:
Probe Type: S | Baro Press: 28.95
Stack I.D.: 20x30

	Port 1 & 2							Port 3 & 4						
Inches From Port	Point#	Delta P Low	Delta P High	Delta P Average	Delta P Sq Root	Stack Temp (F)	Cyclonic Angle	Point#	Delta P Low	Delta P High	Delta P Average	Delta P Sq Root	Stack Temp (F)	Cyclonic Angle
2.5	1	0.55	0.55	0.55	0.7416	97.8	3.8	1	0.28	0.28	0.28	0.5292	103	2.6
5.0	2	0.7	0.7	0.7	0.8367	108	4.8	2	0.31	0.31	0.31	0.5568	105	2.2
7.5	3	0.75	0.75	0.75	0.8660	109	3.0	3	0.42	0.42	0.42	0.6481	107	3.6
10.0	4	0.8	0.8	0.8	0.8944	109	2.6	4	0.42	0.42	0.42	0.6481	108	2.8
12.5	5	0.85	0.85	0.85	0.9220	109	0.8	5	0.5	0.5	0.5	0.7071	107	2.8
15.0	6	1.09	1.09	1.09	1.0440	110	1.8	6	0.7	0.7	0.7	0.8367	109	2.2
17.5	7	1.3	1.3	1.3	1.1402	110	0.5	7	0.91	0.91	0.91	0.9539	109	2.6
2.5	1	0.35	0.35	0.35	0.5916	102	1.8	1	0.45	0.45	0.45	0.6708	105	1.8
5.0	2	0.38	0.38	0.38	0.6164	105	3.0	2	0.52	0.52	0.52	0.7211	105	2.0
7.5	3	0.45	0.45	0.45	0.6708	108	2.0	3	0.6	0.6	0.6	0.7746	109	0.5
10.0	4	0.38	0.38	0.38	0.6164	109	1.2	4	0.6	0.6	0.6	0.7746	109	3.6
12.5	5	0.46	0.46	0.46	0.6782	109	3.2	5	0.4	0.4	0.4	0.6325	109	3.5
15.0	6	0.6	0.6	0.6	0.7746	109	4.5	6	0.8	0.8	0.8	0.8944	108	5.2
17.5	7	0.9	0.9	0.9	0.9487	109	5.2	7	0.85	0.85	0.85	0.9220	107	1.8
										Average Values:	0.6186	0.7718	107.3	2.7

APPENDIX D

Method 4 Calculation

ECSi

Sterigenics - Willowbrook 1 - AAT Inlet
9/21/2018

Saturate Moisture Content (%)

$$B_{ws(svp)}(\%) = 100\left(\frac{10^{\left(6.691-\left(\frac{3144}{T_{s(avg)}+390.86}\right)\right)}}{\left(P_b + \frac{P_{static}}{13.6}\right)}\right)$$

Ts	103	stack temperature (F)
Pb	28.95	barametreric pressure (in Hg)
ps	-0.25	static pressure of stack (in H2O)

Bws(svp) = 7.30 %

Sterigenics - Willowbrook 1 - AAT Outlet
9/21/2018

Saturate Moisture Content (%)

$$B_{ws(svp)}(\%) = 100\left(\frac{10^{\left(6.691-\left(\frac{3144}{T_{s(avg)}+390.86}\right)\right)}}{\left(P_b + \frac{P_{static}}{13.6}\right)}\right)$$

Ts	107	stack temperature (F)
Pb	28.95	barametreric pressure (in Hg)
ps	0.25	static pressure of stack (in H2O)

Bws(svp) = 8.20 %

APPENDIX E

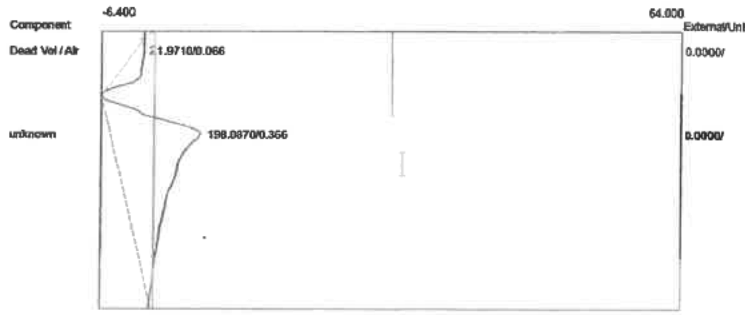
Chromatograms - Backvent

ECSi

Lab name: ECSi
Client: Sterigenics - Willowbrook 1
Client ID: Run#1BV
Analysis date: 09/21/2018 09:14:01
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1Ster1WB2018-1B01.CHR (c:\peak359)
Sample: AAT Inlet
Operator: D. Kremer

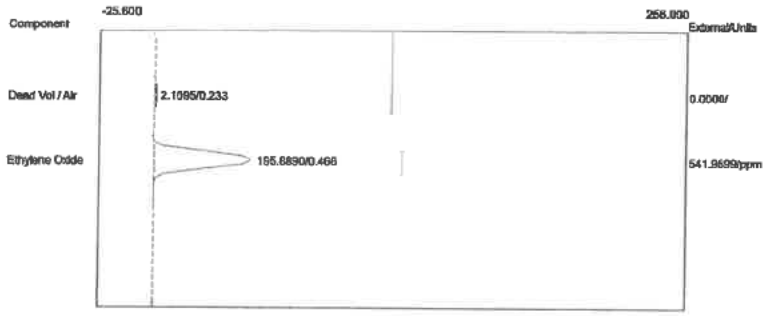
Component	Retention	Area	External	Units
Dead Vol / Air	0.233	2.1460	0.0000	
Ethylene Oxide	0.450	4.1520	11.4872	ppm
		6.2980	11.4872	

Lab name: ECSi
Client: Sterigenics - Willowbrook 1
Client ID: Run#1BV
Analysis date: 09/21/2018 09:14:01
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2Ster1WB2018-1B01.CHR (c:\peak359)
Sample: AAT Outlet
Operator: D. Kremer



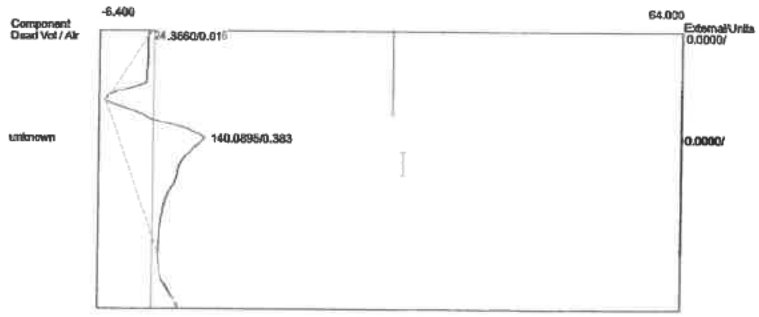
Component	Retention	Area	External	Units
Dead Vol / Air	0.066	21.9710	0.0000	
		21.9710	0.0000	

Lab name: ECSi
Client: Sterigenics - Willowbrook 1
Client ID: Run#1BV
Analysis date: 09/21/2018 09:15:04
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1Ster1WB2018-1B02.CHR (c:\peak359)
Sample: AAT Inlet
Operator: D. Kremer



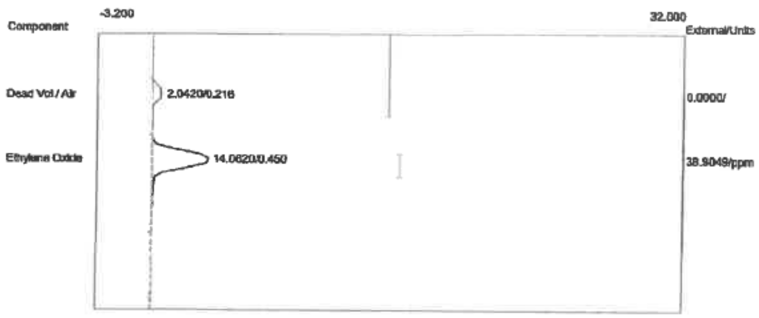
Component	Retention	Area	External	Units
Dead Vol / Air	0.233	2.1095	0.0000	
Ethylene Oxide	0.466	195.8890	541.9599	ppm
		197.9985	541.9599	

Lab name: ECSi
Client: Sterigenics - Willowbrook 1
Client ID: Run#1BV
Analysis date: 09/21/2018 09:15:04
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2Ster1WB2018-1B02.CHR (c:\peak359)
Sample: AAT Outlet
Operator: D. Kremer



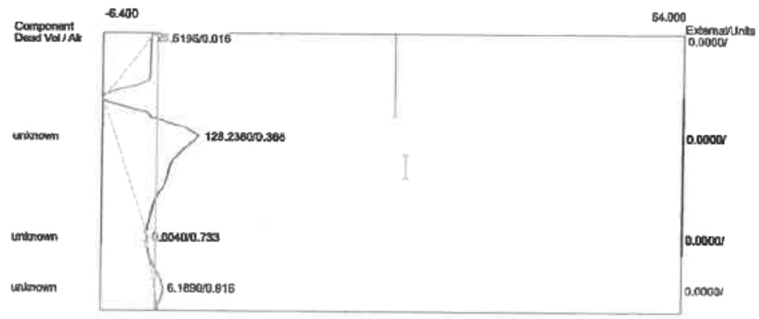
Component	Retention	Area	External	Units
Dead Vol / Air	0.016	24.3660	0.0000	
		24.3660	0.0000	

Lab name: ECSI
Client: Sterigenics - Willowbrook 1
Client ID: Run#1BV
Analysis date: 09/21/2018 09:16:13
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1Ster1WB2018-1B03.CHR (c:\peak359)
Sample: AAT Inlet
Operator: D. Kremer



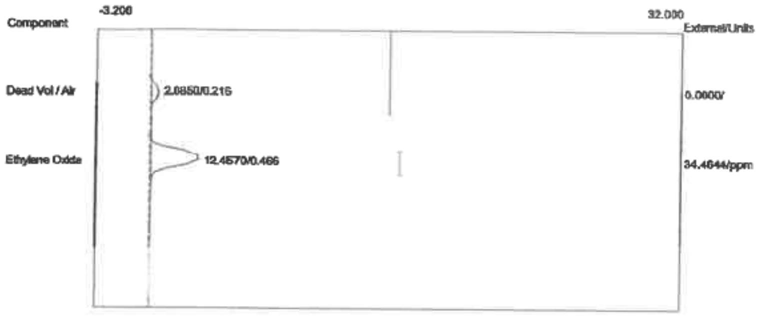
Component	Retention	Area	External	Units
Dead Vol / Air	0.216	2.0420	0.0000	
Ethylene Oxide	0.450	14.0620	38.9049	ppm
		16.1040	38.9049	

Lab name: ECSI
Client: Sterigenics - Willowbrook 1
Client ID: Run#1BV
Analysis date: 09/21/2018 09:16:13
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2Ster1WB2018-1B03.CHR (c:\peak359)
Sample: AAT Outlet
Operator: D. Kremer



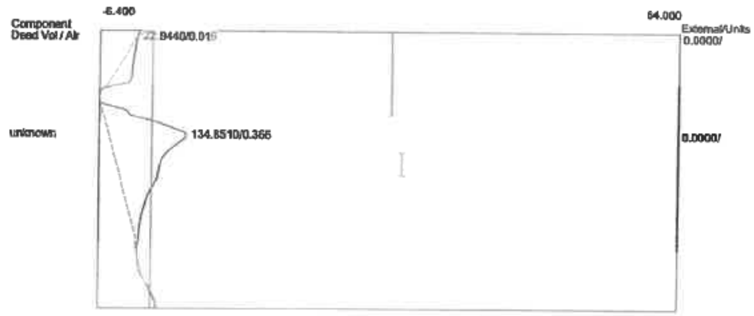
Component	Retention	Area	External	Units
Dead Vol / Air	0.016	26.5195	0.0000	
		26.5195	0.0000	

Lab name: ECSi
Client: Sterigenics - Willowbrook 1
Client ID: Run#1BV
Analysis date: 09/21/2018 09:17:19
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1Ster1WB2018-1B04.CHR (c:\peak359)
Sample: AAT Inlet
Operator: D. Kremer



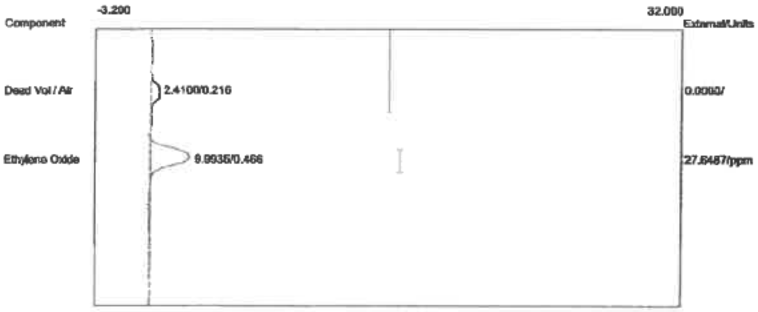
Component	Retention	Area	External	Units
Dead Vol / Air	0.216	2.0850	0.0000	
Ethylene Oxide	0.466	12.4570	34.4644	ppm
		14.5420	34.4644	

Lab name: ECSi
Client: Sterigenics - Willowbrook 1
Client ID: Run#1BV
Analysis date: 09/21/2018 09:17:19
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2Ster1WB2018-1B04.CHR (c:\peak359)
Sample: AAT Outlet
Operator: D. Kremer



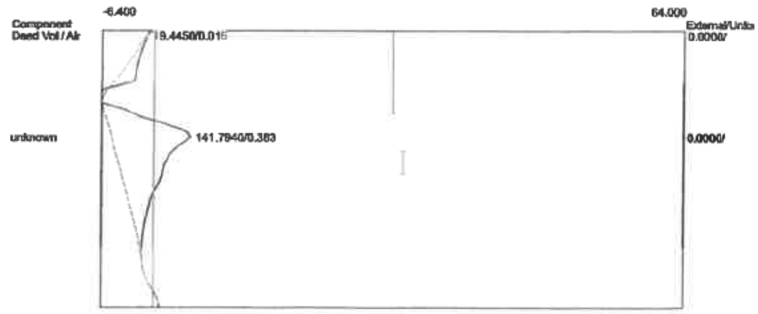
Component	Retention	Area	External	Units
Dead Vol / Air	0.016	22.9440	0.0000	
		22.9440	0.0000	

Lab name: ECSi
Client: Sterigenics - Willowbrook 1
Client ID: Run#1BV
Analysis date: 09/21/2018 09:18:24
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1Ster1WB2018-1B05.CHR (c:\peak359)
Sample: AAT Inlet
Operator: D. Kremer



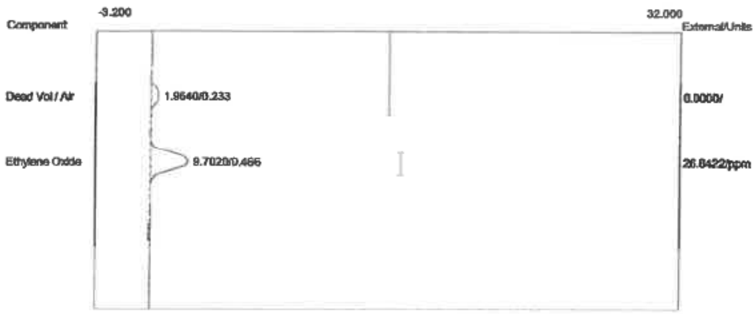
Component	Retention	Area	External	Units
Dead Vol / Air	0.216	2.4100	0.0000	
Ethylene Oxide	0.466	9.9935	27.6487	ppm
		12.4035	27.6487	

Lab name: ECSi
Client: Sterigenics - Willowbrook 1
Client ID: Run#1BV
Analysis date: 09/21/2018 09:18:24
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2Ster1WB2018-1B05.CHR (c:\peak359)
Sample: AAT Outlet
Operator: D. Kremer



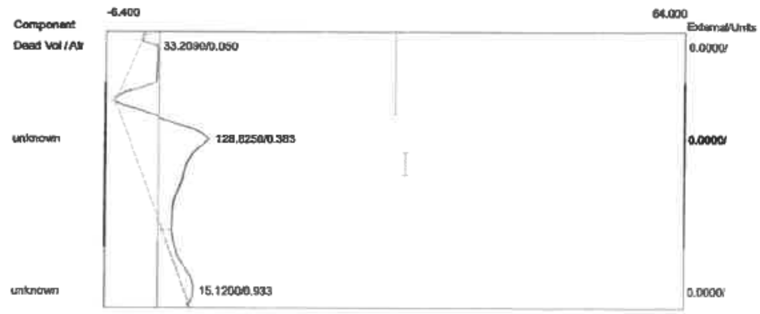
Component	Retention	Area	External	Units
Dead Vol / Air	0.016	19.4450	0.0000	
		19.4450	0.0000	

Lab name: ECSi
Client: Sterigenics - Willowbrook 1
Client ID: Run#1BV
Analysis date: 09/21/2018 09:19:34
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1Ster1WB2018-1B06.CHR (c:\peak359)
Sample: AAT Inlet
Operator: D. Kremer



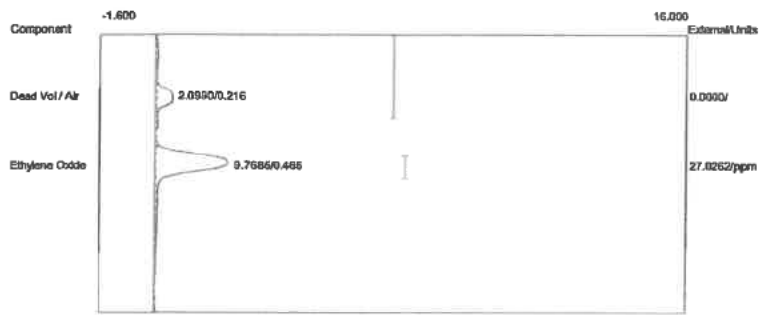
Component	Retention	Area	External	Units
Dead Vol / Air	0.233	1.9640	0.0000	
Ethylene Oxide	0.466	9.7020	26.8422	ppm
		11.6660	26.8422	

Lab name: ECSi
Client: Sterigenics - Willowbrook 1
Client ID: Run#1BV
Analysis date: 09/21/2018 09:19:34
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2Ster1WB2018-1B06.CHR (c:\peak359)
Sample: AAT Outlet
Operator: D. Kremer



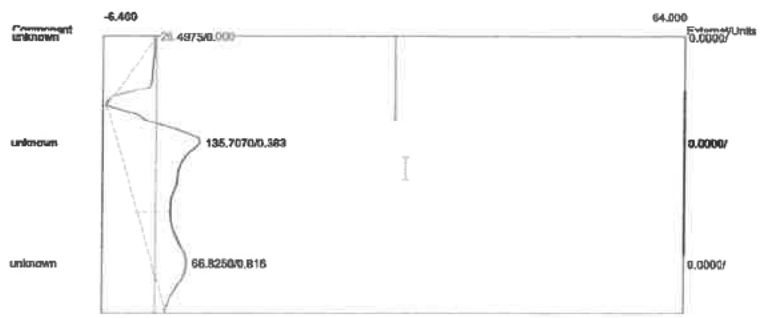
Component	Retention	Area	External	Units
Dead Vol / Air	0.050	33.2090	0.0000	
		33.2090	0.0000	

Lab name: ECSi
Client: Sterigenics - Willowbrook 1
Client ID: Run#1BV
Analysis date: 09/21/2018 09:20:50
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1Ster1WB2018-1B07.CHR (c:\peak359)
Sample: AAT Inlet
Operator: D. Kremer



Component	Retention	Area	External	Units
Dead Vol / Air	0.216	2.0990	0.0000	
Ethylene Oxide	0.466	9.7685	27.0262	ppm
		11.8675	27.0262	

Lab name: ECSi
Client: Sterigenics - Willowbrook 1
Client ID: Run#1BV
Analysis date: 09/21/2018 09:20:50
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2Ster1WB2018-1B07.CHR (c:\peak359)
Sample: AAT Outlet
Operator: D. Kremer

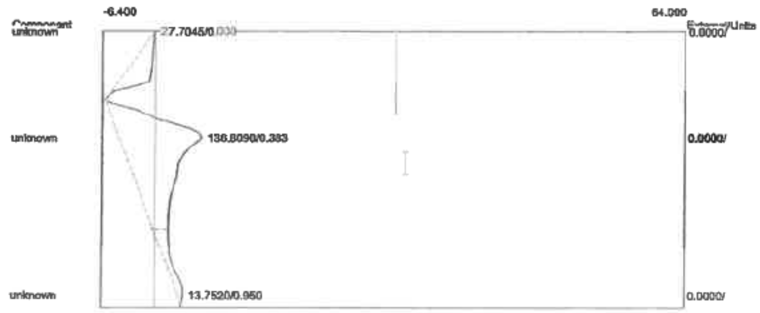


Component	Retention	Area	External	Units
		0.0000	0.0000	

Lab name: ECSi
Client: Sterigenics - Willowbrook 1
Client ID: Run#1BV
Analysis date: 09/21/2018 09:21:58
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1Ster1WB2018-1B08.CHR (c:\peak359)
Sample: AAT Inlet
Operator: D. Kremer

Component	Retention	Area	External	Units
Dead Vol / Air	0.216	2.0870	0.0000	
Ethylene Oxide	0.466	8.3460	23.0906	ppm
		10.4330	23.0906	

Lab name: ECSi
Client: Sterigenics - Willowbrook 1
Client ID: Run#1BV
Analysis date: 09/21/2018 09:21:58
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2Ster1WB2018-1B08.CHR (c:\peak359)
Sample: AAT Outlet
Operator: D. Kremer

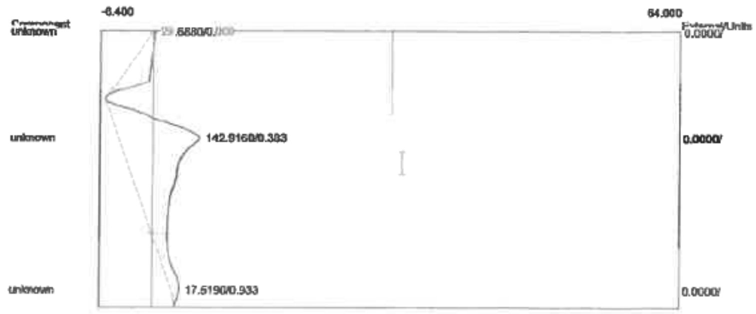


Component	Retention	Area	External	Units
		0.0000	0.0000	

Lab name: ECSi
Client: Sterigenics - Willowbrook 1
Client ID: Run#1BV
Analysis date: 09/21/2018 09:23:07
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1Ster1WB2018-1B09.CHR (c:\peak359)
Sample: AAT Inlet
Operator: D. Kremer

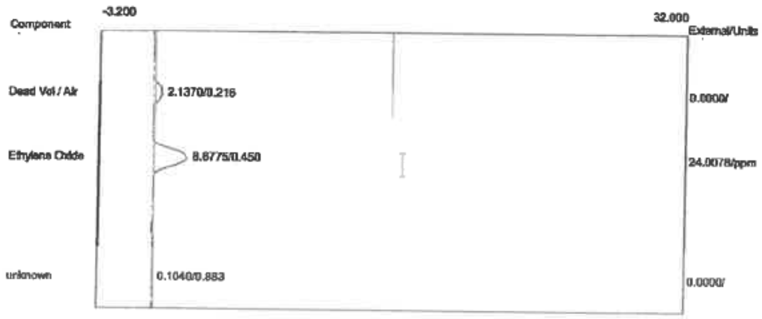
Component	Retention	Area	External	Units
Dead Vol / Air	0.233	2.1435	0.0000	
Ethylene Oxide	0.466	9.5260	26.3553	ppm
		11.6695	26.3553	

Lab name: ECSi
Client: Sterigenics - Willowbrook 1
Client ID: Run#1BV
Analysis date: 09/21/2018 09:23:07
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2Ster1WB2018-1B09.CHR (c:\peak359)
Sample: AAT Outlet
Operator: D. Kremer



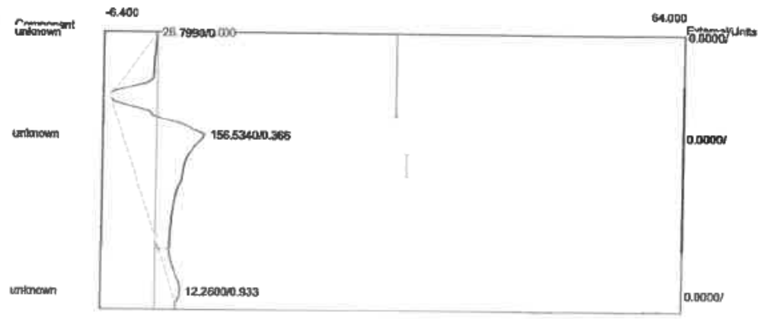
Component	Retention	Area	External	Units
		0.0000	0.0000	

Lab name: ECSi
Client: Sterigenics - Willowbrook 1
Client ID: Run#1BV
Analysis date: 09/21/2018 09:24:16
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1Ster1WB2018-1B10.CHR (c:\peak359)
Sample: AAT Inlet
Operator: D. Kremer



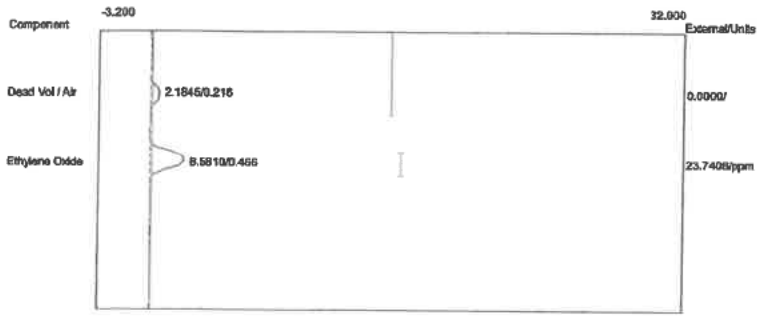
Component	Retention	Area	External	Units
Dead Vol / Air	0.216	2.1370	0.0000	
Ethylene Oxide	0.450	8.6775	24.0078	ppm
		10.8145	24.0078	

Lab name: ECSi
Client: Sterigenics - Willowbrook 1
Client ID: Run#1BV
Analysis date: 09/21/2018 09:24:16
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2Ster1WB2018-1B10.CHR (c:\peak359)
Sample: AAT Outlet
Operator: D. Kremer



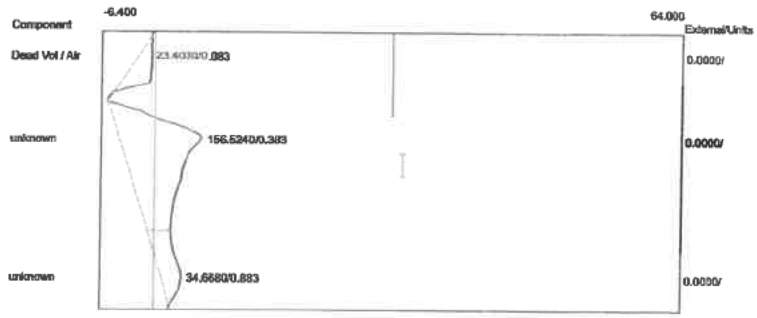
Component	Retention	Area	External	Units
		0.0000	0.0000	

Lab name: ECSi
Client: Sterigenics - Willowbrook 1
Client ID: Run#1BV
Analysis date: 09/21/2018 09:25:27
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1Ster1WB2018-1B11.CHR (c:\peak359)
Sample: AAT Inlet
Operator: D. Kremer



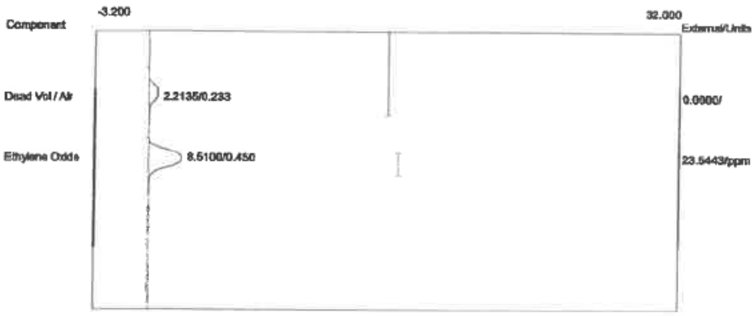
Component	Retention	Area	External	Units
Dead Vol / Air	0.216	2.1845	0.0000	
Ethylene Oxide	0.466	8.5810	23.7408	ppm
		10.7655	23.7408	

Lab name: ECSi
Client: Sterigenics - Willowbrook 1
Client ID: Run#1BV
Analysis date: 09/21/2018 09:25:27
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2Ster1WB2018-1B11.CHR (c:\peak359)
Sample: AAT Outlet
Operator: D. Kremer



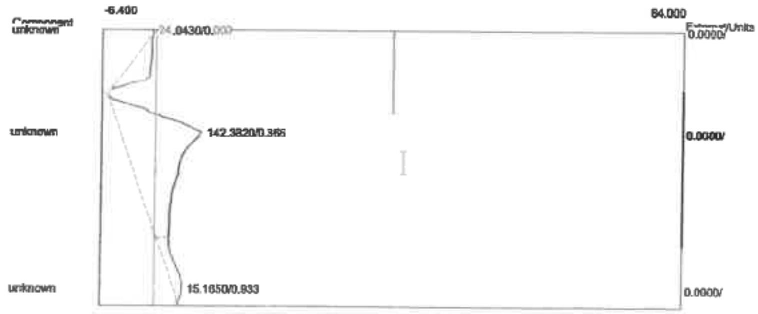
Component	Retention	Area	External	Units
Dead Vol / Air	0.083	23.4030	0.0000	
		23.4030	0.0000	

Lab name: ECSi
Client: Sterigenics - Willowbrook 1
Client ID: Run#1BV
Analysis date: 09/21/2018 09:26:36
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1Ster1WB2018-1B12.CHR (c:\peak359)
Sample: AAT Inlet
Operator: D. Kremer



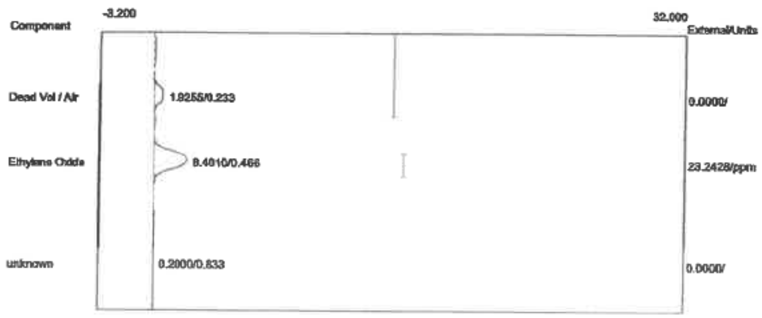
Component	Retention	Area	External	Units
Dead Vol / Air	0.233	2.2135	0.0000	
Ethylene Oxide	0.450	8.5100	23.5443	ppm
		10.7235	23.5443	

Lab name: ECSi
Client: Sterigenics - Willowbrook 1
Client ID: Run#1BV
Analysis date: 09/21/2018 09:26:36
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2Ster1WB2018-1B12.CHR (c:\peak359)
Sample: AAT Outlet
Operator: D. Kremer



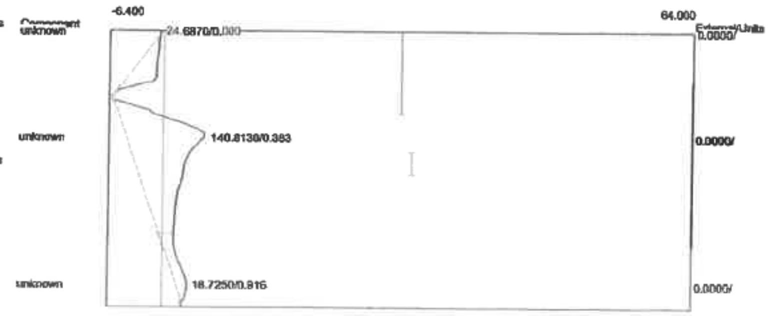
Component	Retention	Area	External	Units
		0.0000	0.0000	

Lab name: ECSi
Client: Sterigenics - Willowbrook 1
Client ID: Run#1BV
Analysis date: 09/21/2018 09:27:45
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1Ster1WB2018-1B13.CHR (c:\peak359)
Sample: AAT Inlet
Operator: D. Kremer



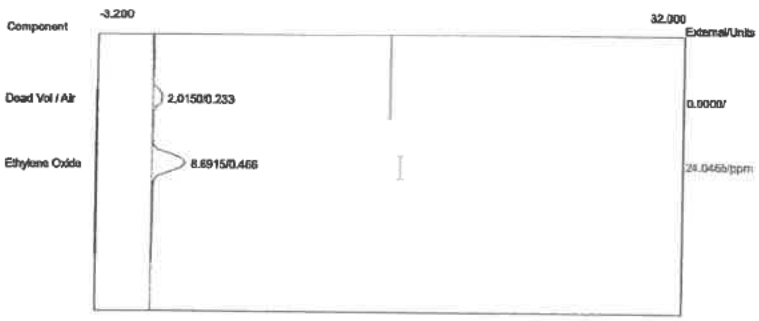
Component	Retention	Area	External	Units
Dead Vol / Air	0.233	1.9255	0.0000	
Ethylene Oxide	0.466	8.4010	23.2428	ppm
		10.3265	23.2428	

Lab name: ECSi
Client: Sterigenics - Willowbrook 1
Client ID: Run#1BV
Analysis date: 09/21/2018 09:27:45
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2Ster1WB2018-1B13.CHR (c:\peak359)
Sample: AAT Outlet
Operator: D. Kremer



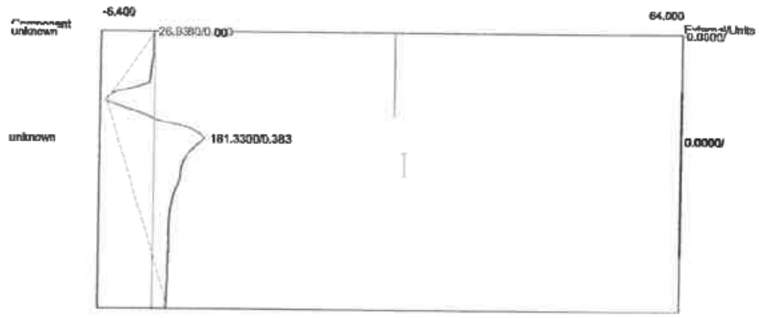
Component	Retention	Area	External	Units
		0.0000	0.0000	

Lab name: ECSi
Client: Sterigenics - Willowbrook 1
Client ID: Run#2BV
Analysis date: 09/21/2018 09:31:03
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1Ster1WB2018-2B01.CHR (c:\peak359)
Sample: AAT Inlet
Operator: D. Kremer



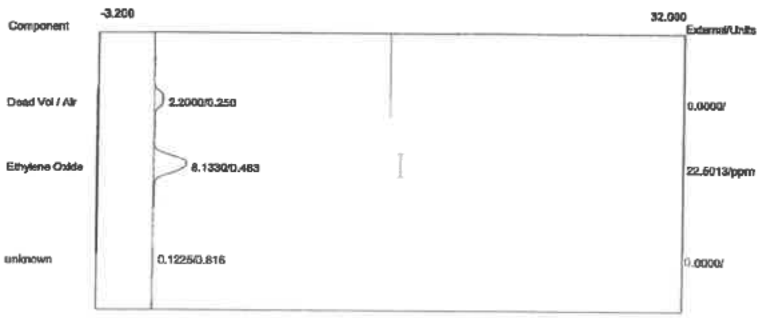
Component	Retention	Area	External	Units
Dead Vol / Air	0.233	2.0150	0.0000	
Ethylene Oxide	0.466	8.6915	24.0465	ppm
		10.7065	24.0465	

Lab name: ECSi
Client: Sterigenics - Willowbrook 1
Client ID: Run#2BV
Analysis date: 09/21/2018 09:31:03
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2Ster1WB2018-2B01.CHR (c:\peak359)
Sample: AAT Outlet
Operator: D. Kremer



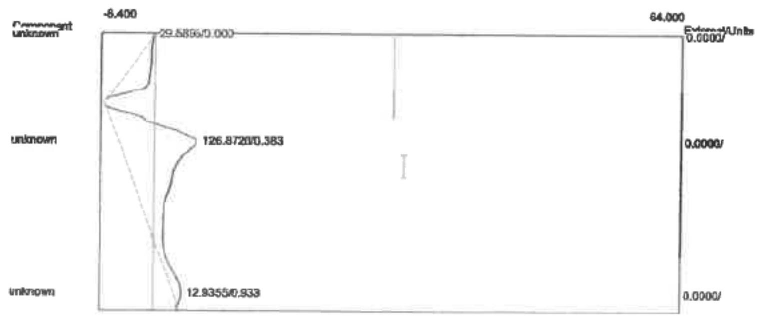
Component	Retention	Area	External	Units
		0.0000	0.0000	

Lab name: ECSi
Client: Sterigenics - Willowbrook 1
Client ID: Run#2BV
Analysis date: 09/21/2018 09:32:13
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1Ster1WB2018-2B02.CHR (c:\peak359)
Sample: AAT Inlet
Operator: D. Kremer



Component	Retention	Area	External	Units
Dead Vol / Air	0.250	2.2000	0.0000	
Ethylene Oxide	0.483	8.1330	22.5013	ppm
		10.3330	22.5013	

Lab name: ECSi
Client: Sterigenics - Willowbrook 1
Client ID: Run#2BV
Analysis date: 09/21/2018 09:32:13
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2Ster1WB2018-2B02.CHR (c:\peak359)
Sample: AAT Outlet
Operator: D. Kremer

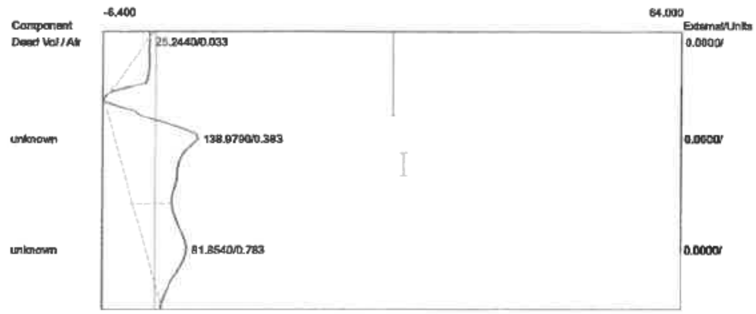


Component	Retention	Area	External	Units
		0.0000	0.0000	

Lab name: ECSi
Client: Sterigenics - Willowbrook 1
Client ID: Run#2BV
Analysis date: 09/21/2018 09:33:30
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1Ster1WB2018-2B03.CHR (c:\peak359)
Sample: AAT Inlet
Operator: D. Kremer

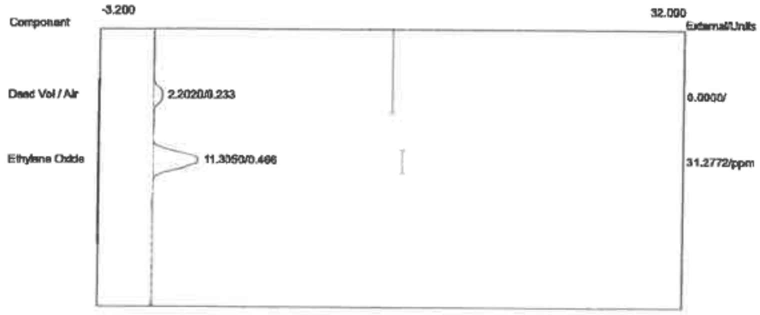
Component	Retention	Area	External	Units
Dead Vol / Air	0.216	2.0750	0.0000	
Ethylene Oxide	0.466	15.2810	42.2775	ppm
		17.3560	42.2775	

Lab name: ECSI
Client: Sterigenics - Willowbrook 1
Client ID: Run#2BV
Analysis date: 09/21/2018 09:33:30
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2Ster1WB2018-2B03.CHR (c:\peak359)
Sample: AAT Outlet
Operator: D. Kremer



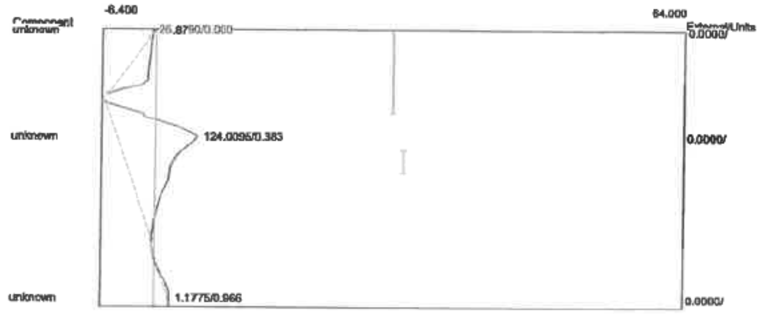
Component	Retention	Area	External	Units
Dead Vol / Air	0.033	25.2440	0.0000	
		25.2440	0.0000	

Lab name: ECSi
Client: Sterigenics - Willowbrook 1
Client ID: Run#2BV
Analysis date: 09/21/2018 09:34:38
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1Ster1WB2018-2B04.CHR (c:\peak359)
Sample: AAT Inlet
Operator: D. Kremer



Component	Retention	Area	External	Units
Dead Vol / Air	0.233	2.2020	0.0000	
Ethylene Oxide	0.466	11.3050	31.2772	ppm
		13.5070	31.2772	

Lab name: ECSi
Client: Sterigenics - Willowbrook 1
Client ID: Run#2BV
Analysis date: 09/21/2018 09:34:38
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2Ster1WB2018-2B04.CHR (c:\peak359)
Sample: AAT Outlet
Operator: D. Kremer



Component	Retention	Area	External	Units
		0.0000	0.0000	

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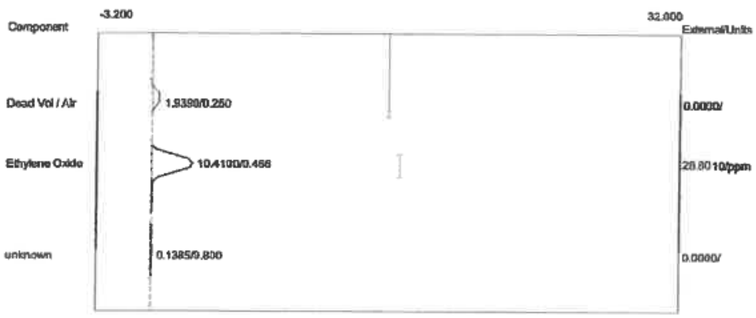
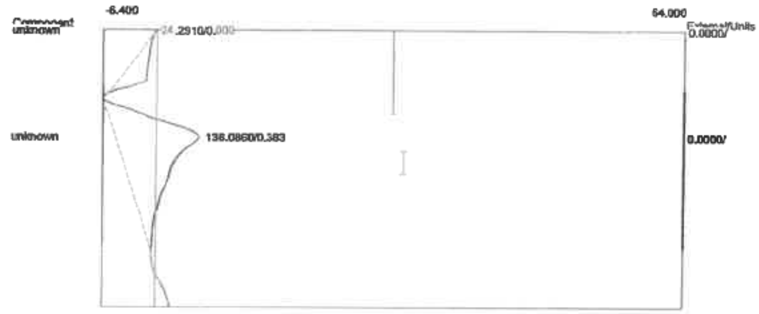
Lab name: ECSi
Client: Sterigenics - Willowbrook 1
Client ID: Run#2BV
Analysis date: 09/21/2018 09:35:43
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1Ster1WB2018-2B05.CHR (c:\peak359)
Sample: AAT Inlet
Operator: D. Kremer



Component	Retention	Area	External	Units
Dead Vol / Air	0.250	1.9390	0.0000	
Ethylene Oxide	0.466	10.4100	28.8010	ppm
		12.3490	28.8010	

Lab name: ECSi
Client: Sterigenics - Willowbrook 1
Client ID: Run#2BV
Analysis date: 09/21/2018 09:35:43
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2Ster1WB2018-2B05.CHR (c:\peak359)
Sample: AAT Outlet
Operator: D. Kremer



Component	Retention	Area	External	Units
		0.0000	0.0000	

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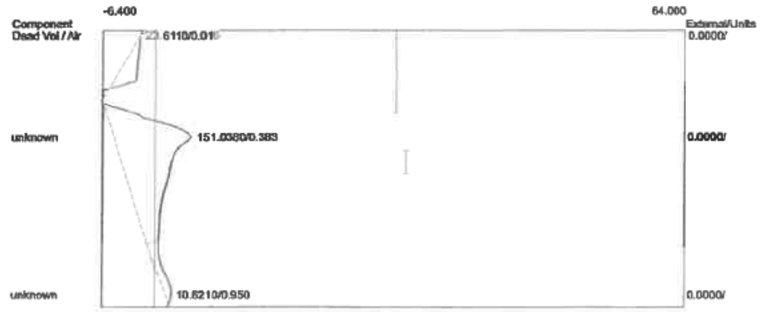
Lab name: ECSi
Client: Sterigenics - Willowbrook 1
Client ID: Run#2BV
Analysis date: 09/21/2018 09:36:51
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1Ster1WB2018-2B06.CHR (c:\peak359)
Sample: AAT Inlet
Operator: D. Kremer

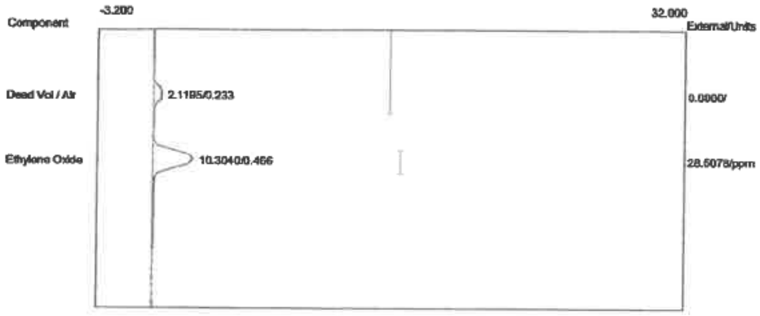
Component	Retention	Area	External	Units
Dead Vol / Air	0.233	2.6125	0.0000	
Ethylene Oxide	0.466	10.3910	28.7485	ppm
		13.0035	28.7485	

Lab name: ECSi
Client: Sterigenics - Willowbrook 1
Client ID: Run#2BV
Analysis date: 09/21/2018 09:36:51
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2Ster1WB2018-2B06.CHR (c:\peak359)
Sample: AAT Outlet
Operator: D. Kremer



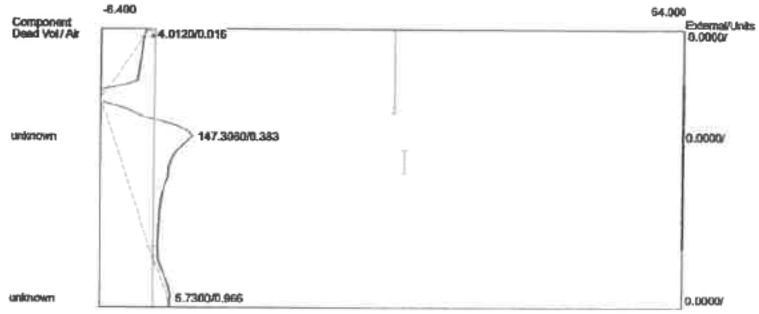
Component	Retention	Area	External	Units
Dead Vol / Air	0.016	23.6110	0.0000	
		23.6110	0.0000	

Lab name: ECSi
Client: Sterigenics - Willowbrook 1
Client ID: Run#2BV
Analysis date: 09/21/2018 09:37:58
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1Ster1WB2018-2B07.CHR (c:\peak359)
Sample: AAT Inlet
Operator: D. Kremer



Component	Retention	Area	External	Units
Dead Vol / Air	0.233	2.1195	0.0000	
Ethylene Oxide	0.466	10.3040	28.5078	ppm
		12.4235	28.5078	

Lab name: ECSi
Client: Sterigenics - Willowbrook 1
Client ID: Run#2BV
Analysis date: 09/21/2018 09:37:58
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2Ster1WB2018-2B07.CHR (c:\peak359)
Sample: AAT Outlet
Operator: D. Kremer

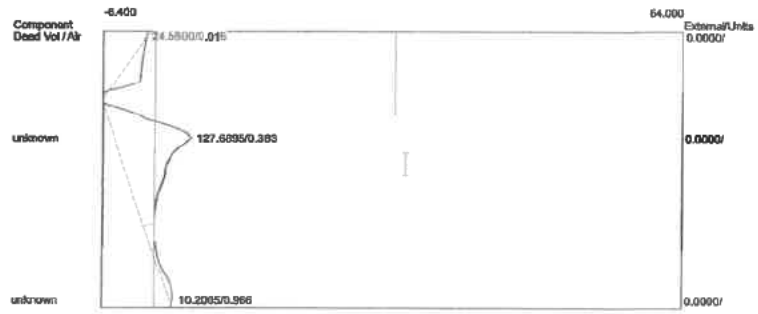


Component	Retention	Area	External	Units
Dead Vol / Air	0.016	24.0120	0.0000	
		24.0120	0.0000	

Lab name: ECSI
Client: Sterigenics - Willowbrook 1
Client ID: Run#2BV
Analysis date: 09/21/2018 09:39:06
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1Ster1WB2018-2B08.CHR (c:\peak359)
Sample: AAT Inlet
Operator: D. Kremer

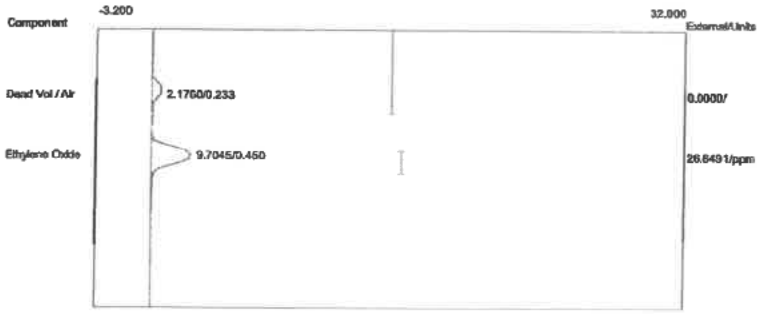
Component	Retention	Area	External	Units
Dead Vol / Air	0.233	2.2375	0.0000	
Ethylene Oxide	0.466	9.6660	26.7426	ppm
		11.9035	26.7426	

Lab name: ECSI
Client: Sterigenics - Willowbrook 1
Client ID: Run#2BV
Analysis date: 09/21/2018 09:39:06
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2Ster1WB2018-2B08.CHR (c:\peak359)
Sample: AAT Outlet
Operator: D. Kremer



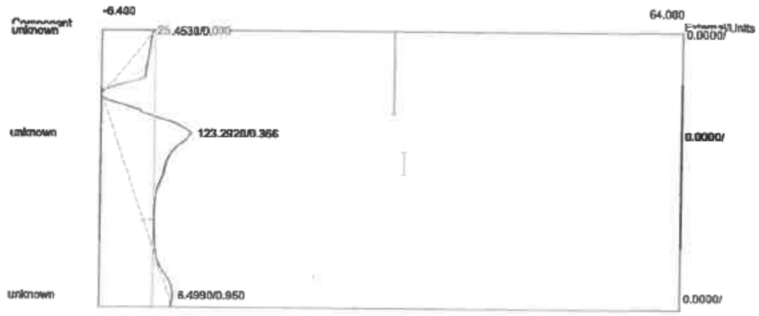
Component	Retention	Area	External	Units
Dead Vol / Air	0.016	24.5800	0.0000	
		24.5800	0.0000	

Lab name: ECSi
Client: Sterigenics - Willowbrook 1
Client ID: Run#2BV
Analysis date: 09/21/2018 09:40:13
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1Ster1WB2018-2B09.CHR (c:\peak359)
Sample: AAT Inlet
Operator: D. Kremer



Component	Retention	Area	External	Units
Dead Vol / Air	0.233	2.1760	0.0000	
Ethylene Oxide	0.450	9.7045	26.8491	ppm
		11.8805	26.8491	

Lab name: ECSi
Client: Sterigenics - Willowbrook 1
Client ID: Run#2BV
Analysis date: 09/21/2018 09:40:13
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2Ster1WB2018-2B09.CHR (c:\peak359)
Sample: AAT Outlet
Operator: D. Kremer



Component	Retention	Area	External	Units
		0.0000	0.0000	

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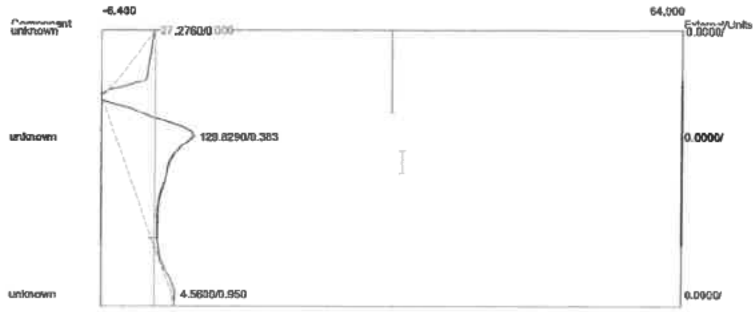
Lab name: ECSi
Client: Sterigenics - Willowbrook 1
Client ID: Run#2BV
Analysis date: 09/21/2018 09:41:21
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1Ster1WB2018-2B10.CHR (c:\peak359)
Sample: AAT Inlet
Operator: D. Kremer

Component	Retention	Area	External	Units
Dead Vol / Air	0.233	2.1475	0.0000	
Ethylene Oxide	0.466	9.5430	26.4023	ppm
		11.6905	26.4023	

Lab name: ECSi
Client: Sterigenics - Willowbrook 1
Client ID: Run#2BV
Analysis date: 09/21/2018 09:41:21
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2Ster1WB2018-2B10.CHR (c:\peak359)
Sample: AAT Outlet
Operator: D. Kremer

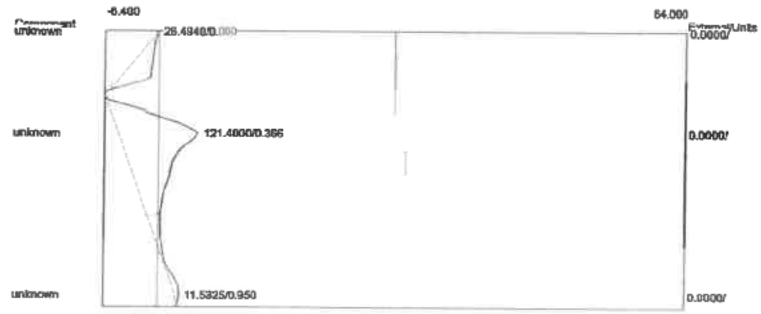


Component	Retention	Area	External	Units
		0.0000	0.0000	

Lab name: ECSi
Client: Sterigenics - Willowbrook 1
Client ID: Run#2BV
Analysis date: 09/21/2018 09:42:29
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1Ster1WB2018-2B11.CHR (c:\peak359)
Sample: AAT Inlet
Operator: D. Kremer

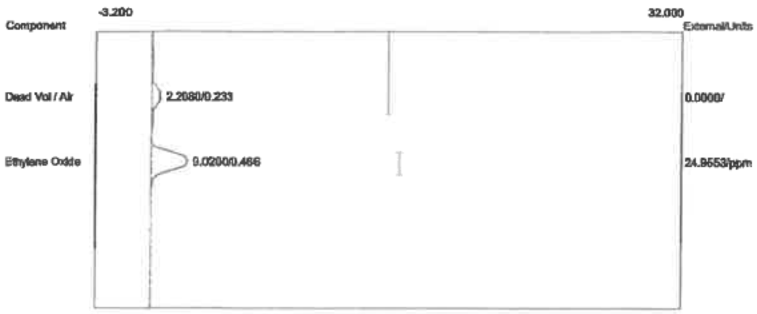
Component	Retention	Area	External	Units
Dead Vol / Air	0.216	2.1555	0.0000	
Ethylene Oxide	0.450	9.7380	26.9418	ppm
		11.8935	26.9418	

Lab name: ECSi
Client: Sterigenics - Willowbrook 1
Client ID: Run#2BV
Analysis date: 09/21/2018 09:42:29
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2Ster1WB2018-2B11.CHR (c:\peak359)
Sample: AAT Outlet
Operator: D. Kremer



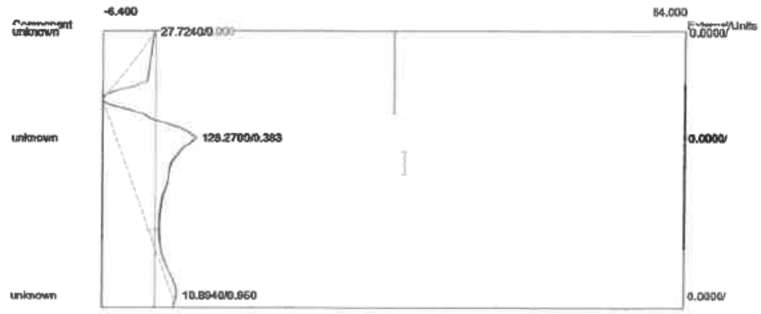
Component	Retention	Area	External	Units
		0.0000	0.0000	

Lab name: ECSi
Client: Sterigenics - Willowbrook 1
Client ID: Run#2BV
Analysis date: 09/21/2018 09:43:37
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1Ster1WB2018-2B12.CHR (c:\peak359)
Sample: AAT Inlet
Operator: D. Kremer



Component	Retention	Area	External	Units
Dead Vol / Air	0.233	2.2080	0.0000	
Ethylene Oxide	0.466	9.0200	24.9553	ppm
		11.2280	24.9553	

Lab name: ECSi
Client: Sterigenics - Willowbrook 1
Client ID: Run#2BV
Analysis date: 09/21/2018 09:43:37
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2Ster1WB2018-2B12.CHR (c:\peak359)
Sample: AAT Outlet
Operator: D. Kremer



Component	Retention	Area	External	Units
		0.0000	0.0000	

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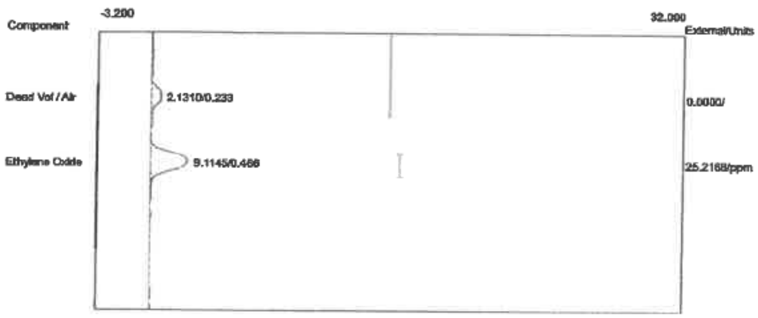
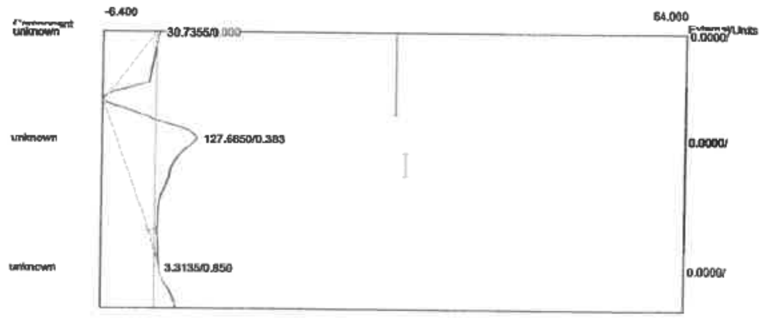
Lab name: ECSi
Client: Sterigenics - Willowbrook 1
Client ID: Run#2BV
Analysis date: 09/21/2018 09:44:42
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1Ster1WB2018-2B13.CHR (c:\peak359)
Sample: AAT Inlet
Operator: D. Kremer



Component	Retention	Area	External	Units
Dead Vol / Air	0.233	2.1310	0.0000	
Ethylene Oxide	0.466	9.1145	25.2168	ppm
		11.2455	25.2168	

Lab name: ECSi
Client: Sterigenics - Willowbrook 1
Client ID: Run#2BV
Analysis date: 09/21/2018 09:44:42
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2Ster1WB2018-2B13.CHR (c:\peak359)
Sample: AAT Outlet
Operator: D. Kremer



Component	Retention	Area	External	Units
		0.0000	0.0000	

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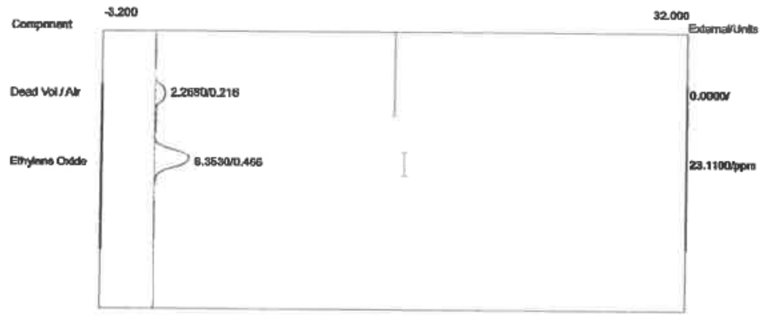
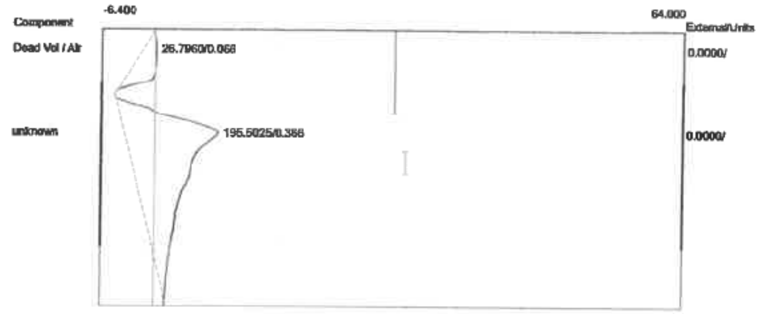
Lab name: ECSi
Client: Sterigenics - Willowbrook 1
Client ID: Run#3BV
Analysis date: 09/21/2018 09:53:04
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1Ster1WB2018-3B01.CHR (c:\peak359)
Sample: AAT Inlet
Operator: D. Kremer



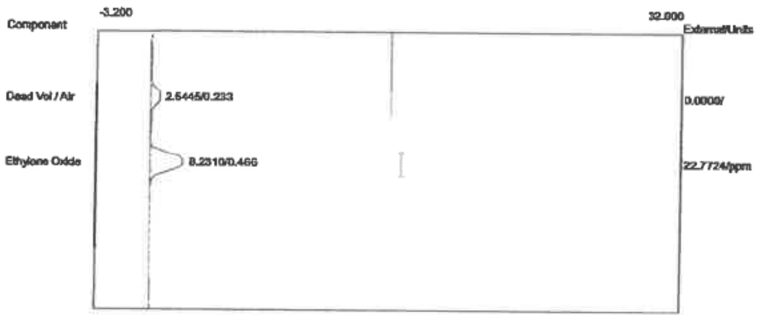
Component	Retention	Area	External	Units
Dead Vol / Air	0.216	2.2680	0.0000	
Ethylene Oxide	0.466	8.3530	23.1100	ppm
		10.6210	23.1100	

Lab name: ECSI
Client: Sterigenics - Willowbrook 1
Client ID: Run#3BV
Analysis date: 09/21/2018 09:53:04
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2Ster1WB2018-3B01.CHR (c:\peak359)
Sample: AAT Outlet
Operator: D. Kremer



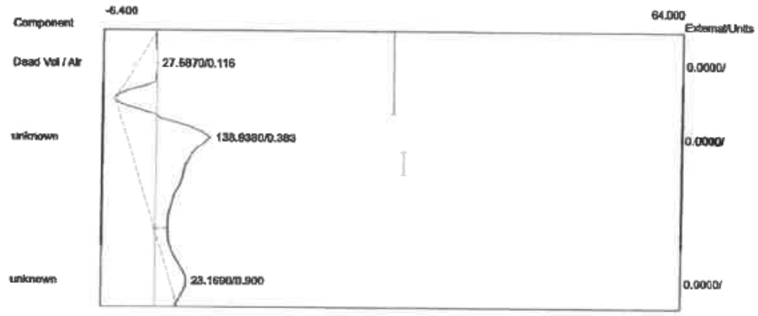
Component	Retention	Area	External	Units
Dead Vol / Air	0.066	26.7960	0.0000	
		26.7960	0.0000	

Lab name: ECSi
Client: Sterigenics - Willowbrook 1
Client ID: Run#3BV
Analysis date: 09/21/2018 09:54:14
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1Ster1WB2018-3B02.CHR (c:\peak359)
Sample: AAT Inlet
Operator: D. Kremer



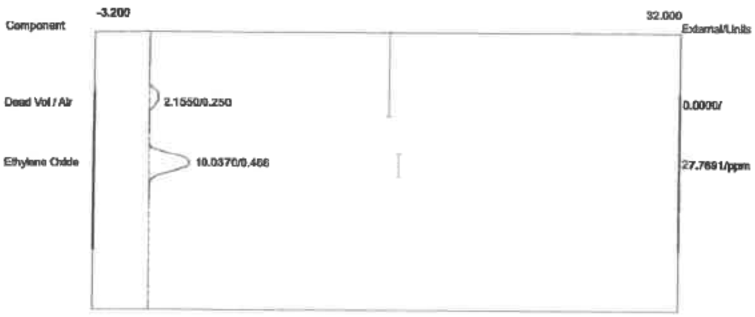
Component	Retention	Area	External	Units
Dead Vol / Air	0.233	2.5445	0.0000	
Ethylene Oxide	0.466	8.2310	22.7724	ppm
		10.7755	22.7724	

Lab name: ECSi
Client: Sterigenics - Willowbrook 1
Client ID: Run#3BV
Analysis date: 09/21/2018 09:54:14
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2Ster1WB2018-3B02.CHR (c:\peak359)
Sample: AAT Outlet
Operator: D. Kremer



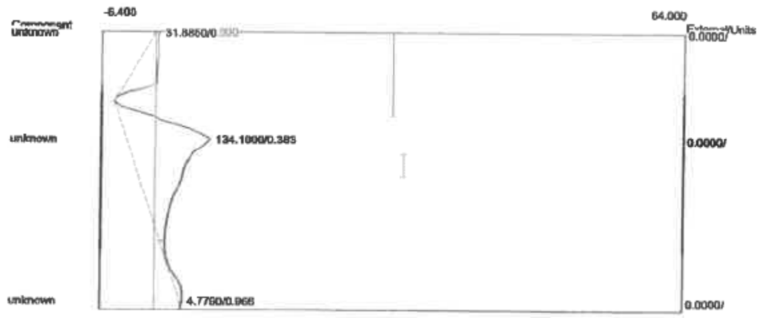
Component	Retention	Area	External	Units
Dead Vol / Air	0.116	27.6870	0.0000	
		27.6870	0.0000	

Lab name: ECSi
Client: Sterigenics - Willowbrook 1
Client ID: Run#3BV
Analysis date: 09/21/2018 09:55:22
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1Ster1WB2018-3B03.CHR (c:\peak359)
Sample: AAT Inlet
Operator: D. Kremer



Component	Retention	Area	External	Units
Dead Vol / Air	0.250	2.1550	0.0000	
Ethylene Oxide	0.466	10.0370	27.7691	ppm
		12.1920	27.7691	

Lab name: ECSi
Client: Sterigenics - Willowbrook 1
Client ID: Run#3BV
Analysis date: 09/21/2018 09:55:22
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2Ster1WB2018-3B03.CHR (c:\peak359)
Sample: AAT Outlet
Operator: D. Kremer

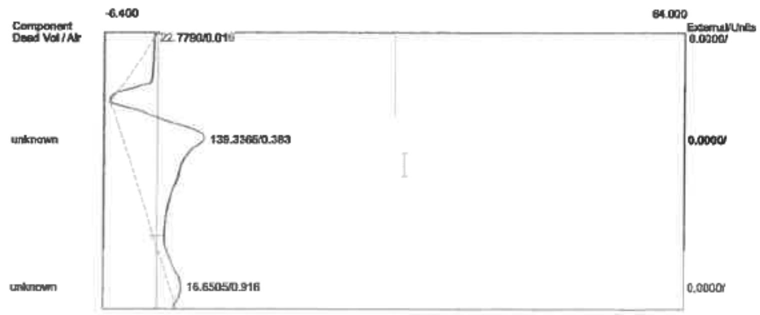


Component	Retention	Area	External	Units
		0.0000	0.0000	

Lab name: ECSi
Client: Sterigenics - Willowbrook 1
Client ID: Run#3BV
Analysis date: 09/21/2018 09:56:32
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1Ster1WB2018-3B04.CHR (c:\peak359)
Sample: AAT Inlet
Operator: D. Kremer

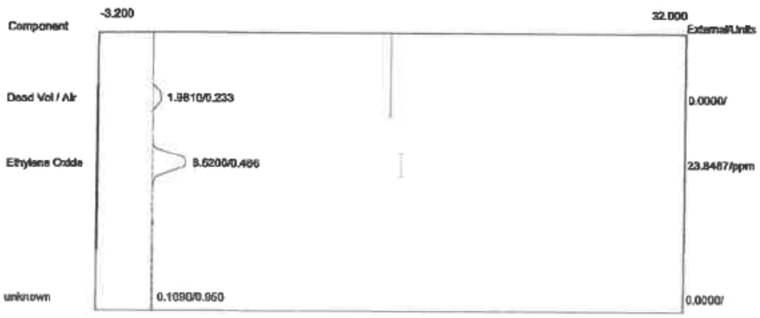
Component	Retention	Area	External	Units
Dead Vol / Air	0.233	2.2050	0.0000	
Ethylene Oxide	0.466	9.4150	26.0482	ppm
		11.6200	26.0482	

Lab name: ECSi
Client: Sterigenics - Willowbrook 1
Client ID: Run#3BV
Analysis date: 09/21/2018 09:56:32
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2Ster1WB2018-3B04.CHR (c:\peak359)
Sample: AAT Outlet
Operator: D. Kremer



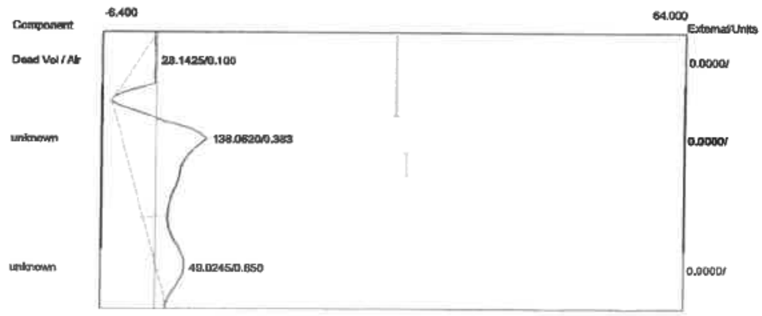
Component	Retention	Area	External	Units
Dead Vol / Air	0.016	22.7790	0.0000	
		22.7790	0.0000	

Lab name: ECSi
Client: Sterigenics - Willowbrook 1
Client ID: Run#3BV
Analysis date: 09/21/2018 09:57:46
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1Ster1WB2018-3B05.CHR (c:\peak359)
Sample: AAT Inlet
Operator: D. Kremer



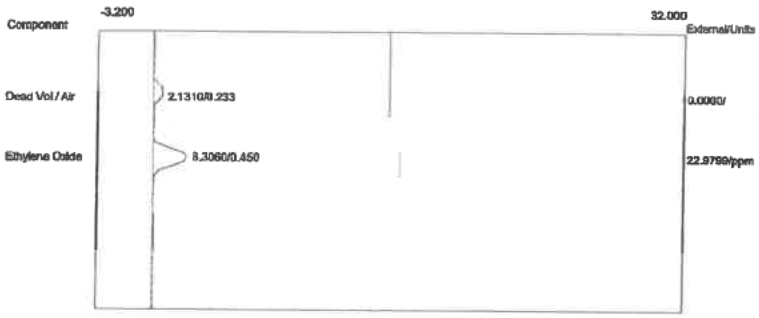
Component	Retention	Area	External	Units
Dead Vol / Air	0.233	1.9810	0.0000	
Ethylene Oxide	0.466	8.6200	23.8487	ppm
		10.6010	23.8487	

Lab name: ECSi
Client: Sterigenics - Willowbrook 1
Client ID: Run#3BV
Analysis date: 09/21/2018 09:57:46
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2Ster1WB2018-3B05.CHR (c:\peak359)
Sample: AAT Outlet
Operator: D. Kremer



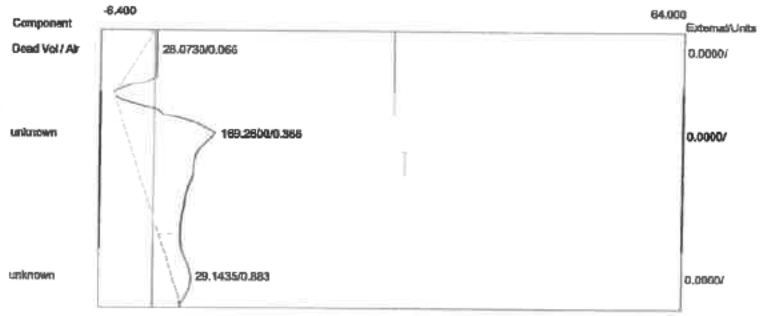
Component	Retention	Area	External	Units
Dead Vol / Air	0.100	28.1425	0.0000	
		28.1425	0.0000	

Lab name: ECSi
Client: Sterigenics - Willowbrook 1
Client ID: Run#3BV
Analysis date: 09/21/2018 09:58:56
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1Ster1WB2018-3B06.CHR (c:\peak359)
Sample: AAT Inlet
Operator: D. Kremer



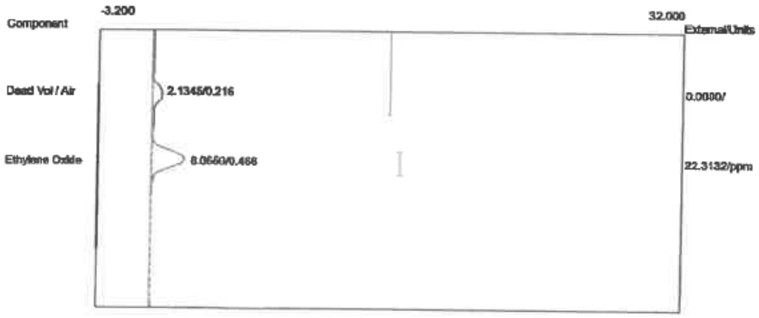
Component	Retention	Area	External	Units
Dead Vol / Air	0.233	2.1310	0.0000	
Ethylene Oxide	0.450	8.3060	22.9799	ppm
		10.4370	22.9799	

Lab name: ECSi
Client: Sterigenics - Willowbrook 1
Client ID: Run#3BV
Analysis date: 09/21/2018 09:58:56
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2Ster1WB2018-3B06.CHR (c:\peak359)
Sample: AAT Outlet
Operator: D. Kremer



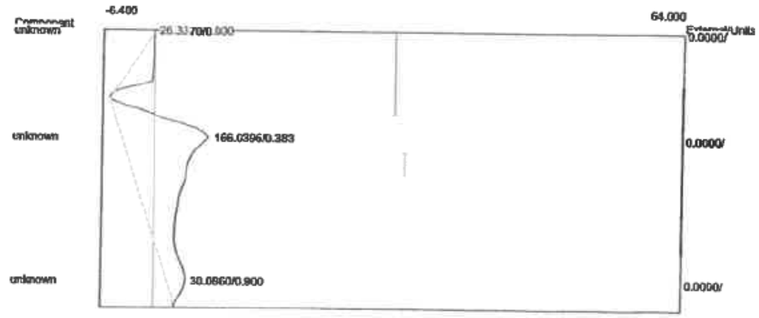
Component	Retention	Area	External	Units
Dead Vol / Air	0.066	28.0730	0.0000	
		28.0730	0.0000	

Lab name: ECSi
Client: Sterigenics - Willowbrook 1
Client ID: Run#3BV
Analysis date: 09/21/2018 10:00:07
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1Ster1WB2018-3B07.CHR (c:\peak359)
Sample: AAT Inlet
Operator: D. Kremer



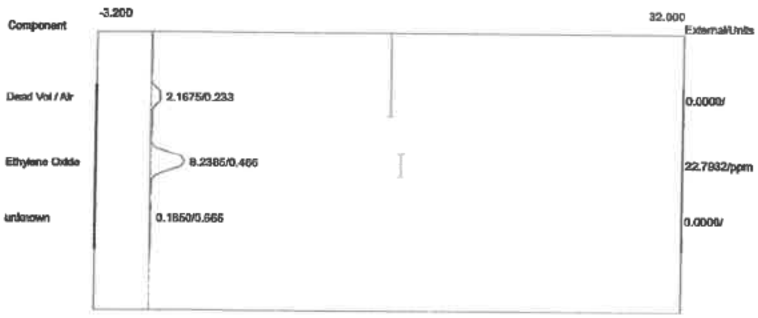
Component	Retention	Area	External	Units
Dead Vol / Air	0.216	2.1345	0.0000	
Ethylene Oxide	0.466	8.0650	22.3132	ppm
		10.1995	22.3132	

Lab name: ECSi
Client: Sterigenics - Willowbrook 1
Client ID: Run#3BV
Analysis date: 09/21/2018 10:00:07
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2Ster1WB2018-3B07.CHR (c:\peak359)
Sample: AAT Outlet
Operator: D. Kremer



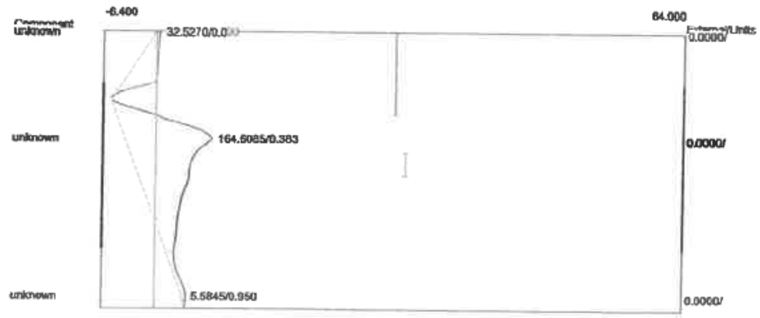
Component	Retention	Area	External	Units
		0.0000	0.0000	

Lab name: ECSi
Client: Sterigenics - Willowbrook 1
Client ID: Run#3BV
Analysis date: 09/21/2018 10:01:14
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1Ster1WB2018-3B08.CHR (c:\peak359)
Sample: AAT Inlet
Operator: D. Kremer



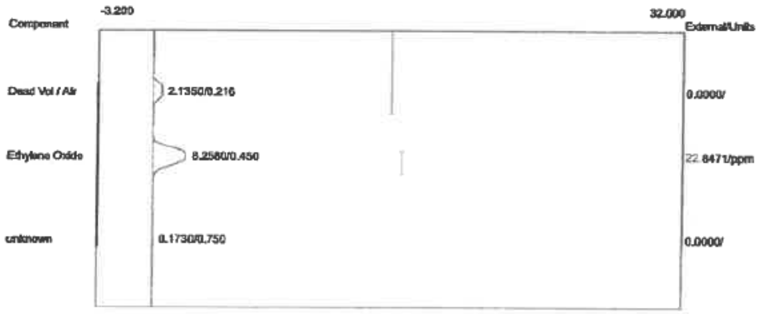
Component	Retention	Area	External	Units
Dead Vol / Air	0.233	2.1675	0.0000	
Ethylene Oxide	0.466	8.2385	22.7932	ppm
		10.4060	22.7932	

Lab name: ECSi
Client: Sterigenics - Willowbrook 1
Client ID: Run#3BV
Analysis date: 09/21/2018 10:01:14
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2Ster1WB2018-3B08.CHR (c:\peak359)
Sample: AAT Outlet
Operator: D. Kremer



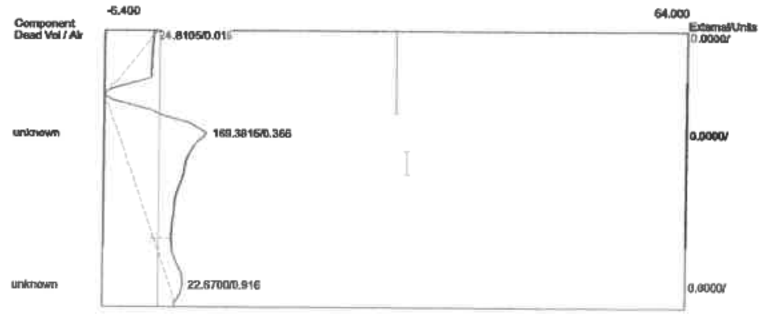
Component	Retention	Area	External	Units
		0.0000	0.0000	

Lab name: ECSi
Client: Sterigenics - Willowbrook 1
Client ID: Run#3BV
Analysis date: 09/21/2018 10:02:23
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1Ster1WB2018-3B09.CHR (c:\peak359)
Sample: AAT Inlet
Operator: D. Kremer



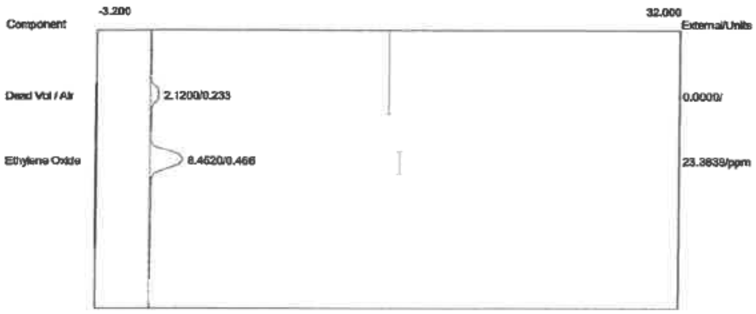
Component	Retention	Area	External	Units
Dead Vol / Air	0.216	2.1350	0.0000	
Ethylene Oxide	0.450	8.2580	22.8471	ppm
		10.3930	22.8471	

Lab name: ECSi
Client: Sterigenics - Willowbrook 1
Client ID: Run#3BV
Analysis date: 09/21/2018 10:02:23
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2Ster1WB2018-3B09.CHR (c:\peak359)
Sample: AAT Outlet
Operator: D. Kremer



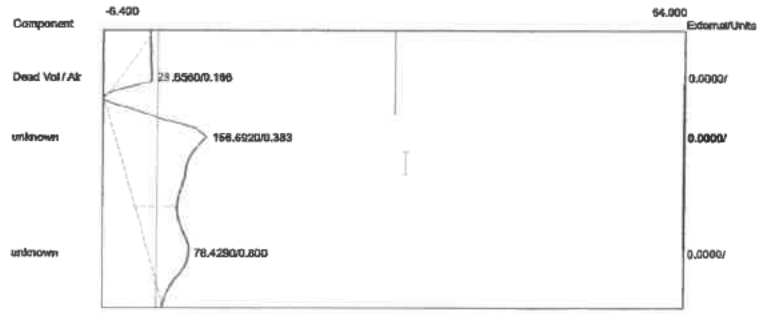
Component	Retention	Area	External	Units
Dead Vol / Air	0.016	24.8105	0.0000	
		24.8105	0.0000	

Lab name: ECSi
Client: Sterigenics - Willowbrook 1
Client ID: Run#3BV
Analysis date: 09/21/2018 10:03:40
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1Ster1WB2018-3B10.CHR (c:\peak359)
Sample: AAT Inlet
Operator: D. Kremer



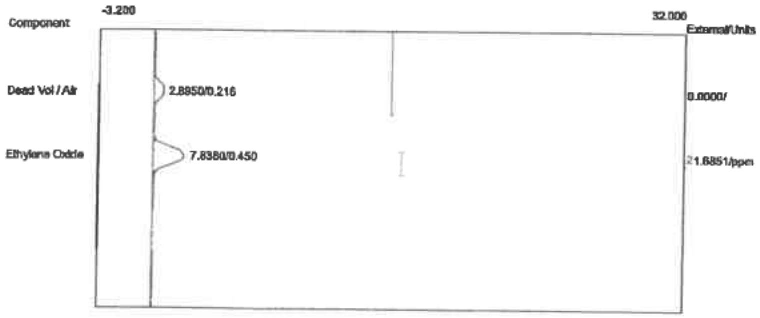
Component	Retention	Area	External	Units
Dead Vol / Air	0.233	2.1200	0.0000	
Ethylene Oxide	0.466	8.4520	23.3839	ppm
		10.5720	23.3839	

Lab name: ECSi
Client: Sterigenics - Willowbrook 1
Client ID: Run#3BV
Analysis date: 09/21/2018 10:03:40
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2Ster1WB2018-3B10.CHR (c:\peak359)
Sample: AAT Outlet
Operator: D. Kremer



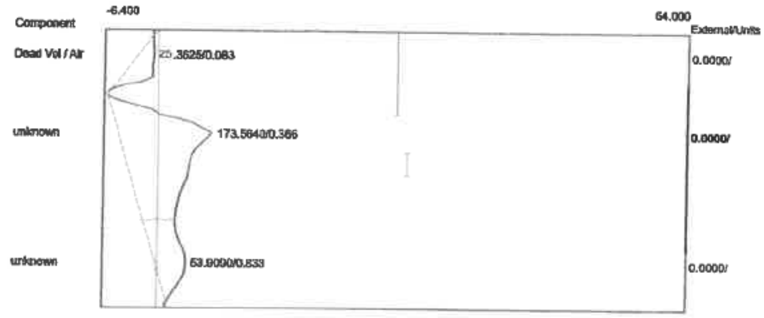
Component	Retention	Area	External	Units
Dead Vol / Air	0.166	28.6560	0.0000	
		28.6560	0.0000	

Lab name: ECSi
Client: Sterigenics - Willowbrook 1
Client ID: Run#3BV
Analysis date: 09/21/2018 10:04:53
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1Ster1WB2018-3B11.CHR (c:\peak359)
Sample: AAT Inlet
Operator: D. Kremer



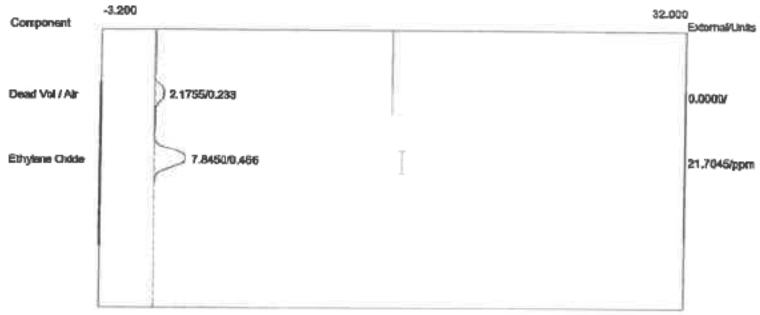
Component	Retention	Area	External	Units
Dead Vol / Air	0.216	2.8950	0.0000	
Ethylene Oxide	0.450	7.8380	21.6851	ppm
		10.7330	21.6851	

Lab name: ECSI
Client: Sterigenics - Willowbrook 1
Client ID: Run#3BV
Analysis date: 09/21/2018 10:04:53
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2Ster1WB2018-3B11.CHR (c:\peak359)
Sample: AAT Outlet
Operator: D. Kremer



Component	Retention	Area	External	Units
Dead Vol / Air	0.083	25.3625	0.0000	
		25.3625	0.0000	

Lab name: ECSi
Client: Sterigenics - Willowbrook 1
Client ID: Run#3BV
Analysis date: 09/21/2018 10:06:02
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1Ster1WB2018-3B12.CHR (c:\peak359)
Sample: AAT Inlet
Operator: D. Kremer

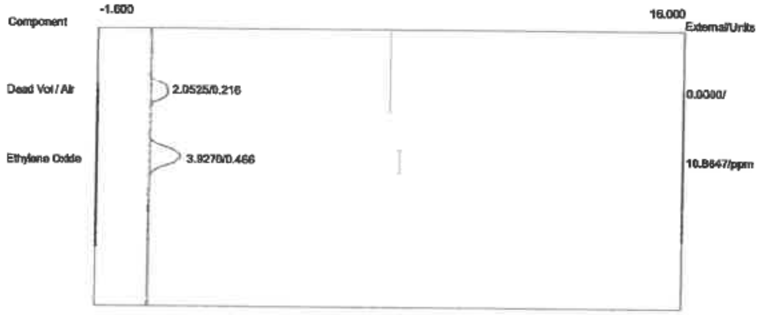


Component	Retention	Area	External	Units
Dead Vol / Air	0.233	2.1755	0.0000	
Ethylene Oxide	0.466	7.8450	21.7045	ppm
		10.0205	21.7045	

Lab name: ECSi
Client: Sterigenics - Willowbrook 1
Client ID: Run#3BV
Analysis date: 09/21/2018 10:06:02
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2Ster1WB2018-3B12.CHR (c:\peak359)
Sample: AAT Outlet
Operator: D. Kremer

Component	Retention	Area	External	Units
		0.0000	0.0000	

Lab name: ECSi
Client: Sterigenics - Willowbrook 1
Client ID: Aeration
Analysis date: 09/21/2018 09:09:51
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1Ster1WB2018-A04.CHR (c:\peak359)
Sample: AAT Inlet
Operator: D. Kremer

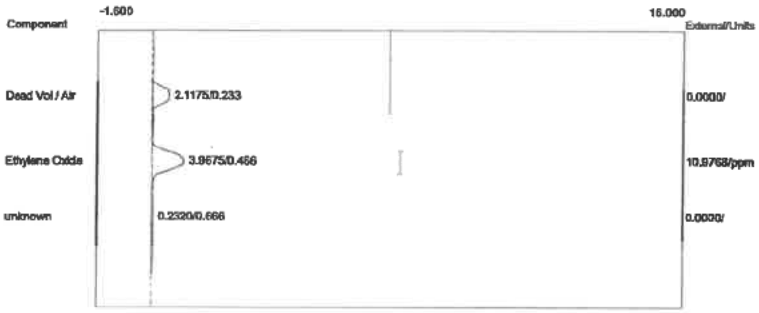


Component	Retention	Area	External	Units
Dead Vol / Air	0.216	2.0525	0.0000	
Ethylene Oxide	0.466	3.9270	10.8647	ppm
		5.9795	10.8647	

Lab name: ECSi
Client: Sterigenics - Willowbrook 1
Client ID: Aeration
Analysis date: 09/21/2018 09:09:51
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2Ster1WB2018-A04.CHR (c:\peak359)
Sample: AAT Outlet
Operator: D. Kremer

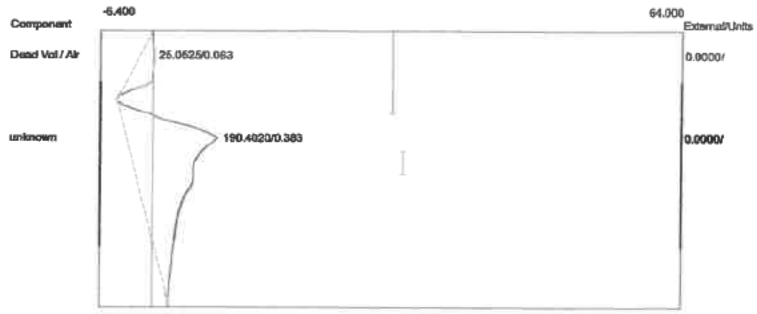
Component	Retention	Area	External	Units
Dead Vol / Air	0.083	24.1980	0.0000	
		24.1980	0.0000	

Lab name: ECSi
Client: Sterigenics - Willowbrook 1
Client ID: Aeration
Analysis date: 09/21/2018 09:07:10
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1Ster1WB2018-A03.CHR (c:\peak359)
Sample: AAT Inlet
Operator: D. Kremer



Component	Retention	Area	External	Units
Dead Vol / Air	0.233	2.1175	0.0000	
Ethylene Oxide	0.466	3.9675	10.9768	ppm
		6.0850	10.9768	

Lab name: ECSi
Client: Sterigenics - Willowbrook 1
Client ID: Aeration
Analysis date: 09/21/2018 09:07:10
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2Ster1WB2018-A03.CHR (c:\peak359)
Sample: AAT Outlet
Operator: D. Kremer



Component	Retention	Area	External	Units
Dead Vol / Air	0.083	25.0525	0.0000	
		25.0525	0.0000	

APPENDIX F

Field Data

ECSI, INC. - VELOCITY TRAVERSE DATA

Client: Sterigenics
Location: Willowbrook - Plant 1
Source: AAT Safe Cell System Inlet

Run #: 1
Probe Type: Std.
Stack I.D.: 36 In.
Date: ~~9/8/2016~~ 9/21/18
Baro Press: ~~29.06~~ ~~29.00~~ 28.95
DSCFM:
Port Sketch: 2 1

Inches From Port	Port 1 Point#	Delta P Low	Delta P High	Delta P Average	Delta P Sq Root	Stack Temp (F)	Cyclonic Angle	Port 2 Point#	Delta P Low	Delta P High	Delta P Average	Delta P Sq Root	Stack Temp (F)	Cyclonic Angle
0.7	1	0.25	0.25	#DIV/0!	#DIV/0!	101.2	1.5	1	0.21	0.21	#DIV/0!	#DIV/0!	103.3	5.0
2.4	2	0.15	0.15	#DIV/0!	#DIV/0!	101.2	5.6	2	0.22	0.22	#DIV/0!	#DIV/0!	103.3	4.6
4.2	3	0.18	0.18	#DIV/0!	#DIV/0!	~~101.7~~ 102	2.0	3	0.21	0.21	#DIV/0!	#DIV/0!	103.2	3.6
6.3	4	0.20	0.20	#DIV/0!	#DIV/0!	102.2	1.8	4	0.25	0.25	#DIV/0!	#DIV/0!	103.1	5.1
9.0	5	0.21	0.21	#DIV/0!	#DIV/0!	102.4	~~1.0~~	5	0.23	0.23	#DIV/0!	#DIV/0!	102.9	3.0
12.9	6	0.25	0.25	#DIV/0!	#DIV/0!	102.5	0.5	6	0.25	0.25	#DIV/0!	#DIV/0!	102.8	2.6
23.1	7	0.21	0.21	#DIV/0!	#DIV/0!	103.5	1.0	7	0.16	0.16	#DIV/0!	#DIV/0!	102.6	8.8
27.0	8	0.23	0.23	#DIV/0!	#DIV/0!	104	1.4	8	0.19	0.19	#DIV/0!	#DIV/0!	102.6	6.3
29.7	9	0.17	0.25	#DIV/0!	#DIV/0!	104.3	2.4	9	0.24	0.24	#DIV/0!	#DIV/0!	102.5	4.1
31.8	10	0.19	0.19	#DIV/0!	#DIV/0!	104.4	0.5	10	0.22	0.22	#DIV/0!	#DIV/0!	102.5	2.2
33.6	11	0.26	0.26	#DIV/0!	#DIV/0!	104.6	1.3	11	0.26	0.26	#DIV/0!	#DIV/0!	102.4	2.8
35.3	12	0.19	0.19	#DIV/0!	#DIV/0!	105	1.8	12	0.22	0.22	#DIV/0!	#DIV/0!	102.5	2.1
	13							13						
	14							14						
	15							15						
	16							16						
	17							17						
	18							18						
	19							19						
	20							20						
	21							21						
	22							22						
	23							23						
	24							24						
								Average Values:			#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!

* Stack static pressure measured at -0.25" H_2O
* pitot tube P-4-2 was leak checked @ 2" H_2O, max scale on the manometer

ECSI, INC. - VELOCITY TRAVERSE DATA

Client: Sterigenics
Location: Willowbrook - Plant 1
Source: AAT Safe Cell System Inlet

Run #: 1
Probe Type: Std.
Stack I.D.: 36 In.
Date: ~~9/8/2018~~ 9/21/18
Baro Press: ~~29.35~~ 29.00
DSCFM:
Port Sketch: 2 1

	Port 1							Port 2						
Inches		Delta P				Stack	Cyclonic		Delta P				Stack	Cyclonic
From Port	Point#	Low	High	Average	Sq Root	Temp (F)	Angle	Point#	Low	High	Average	Sq Root	Temp (F)	Angle
0.7	1	0.25	0.25	#DIV/0!	#DIV/0!	101.2	1.5	1	0.21	0.21	#DIV/0!	#DIV/0!	103.3	5.0
2.4	2	0.15	0.15	#DIV/0!	#DIV/0!	101.2	5.6	2	0.22	0.22	#DIV/0!	#DIV/0!	103.3	4.6
4.2	3	0.18	0.18	#DIV/0!	#DIV/0!	102 ~~101.7~~	2.0	3	0.21	0.21	#DIV/0!	#DIV/0!	103.2	3.6
6.3	4	0.20	0.20	#DIV/0!	#DIV/0!	102.2	1.8	4	0.25	0.25	#DIV/0!	#DIV/0!	103.1	5.1
9.0	5	0.21	0.21	#DIV/0!	#DIV/0!	102.4	~~[illegible]~~	5	0.23	0.23	#DIV/0!	#DIV/0!	102.9	3.0
12.9	6	0.25	0.25	#DIV/0!	#DIV/0!	102.5	0.5	6	0.25	0.25	#DIV/0!	#DIV/0!	102.8	2.6
23.1	7	0.21	0.21	#DIV/0!	#DIV/0!	103.5	1.0	7	0.16	0.16	#DIV/0!	#DIV/0!	102.6	8.8
27.0	8	0.23	0.23	#DIV/0!	#DIV/0!	104	1.4	8	0.19	0.19	#DIV/0!	#DIV/0!	102.6	6.3
29.7	9	0.17	0.25	#DIV/0!	#DIV/0!	104.3	2.4	9	0.24	0.24	#DIV/0!	#DIV/0!	102.5	4.1
31.8	10	0.19	0.19	#DIV/0!	#DIV/0!	104.4	0.5	10	0.22	0.22	#DIV/0!	#DIV/0!	102.5	2.2
33.6	11	0.26	0.26	#DIV/0!	#DIV/0!	104.6	1.3	11	0.26	0.26	#DIV/0!	#DIV/0!	102.4	2.8
35.3	12	0.19	0.19	#DIV/0!	#DIV/0!	105	1.8	12	0.22	0.22	#DIV/0!	#DIV/0!	102.5	2.1
	13							13						
	14							14						
	15							15						
	16							16						
	17							17						
	18							18						
	19							19						
	20							20						
	21							21						
	22							22						
	23							23						
	24							24						
									Average Values:		#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!

* pitot tube P-4-2 was leak checked @ 2" H_2O, max scale on the manometer

ECSI, INC. - VELOCITY TRAVERSE DATA

Client: Sterigenics
Location: Willowbrook - Plant 1
Source: AAT Safe Cell System Outlet

Run #: 1
Probe Type: Std.
Stack I.D.: 20x30 ≈ 4.17 ft^2
Date: ~~11/7/2017~~ 9/21/18
Baro Press: ~~29.86~~ ~~29.09~~ 28.95
DSCFM:
Port Sketch:

0	0	0	0
1	2	3	4

	Port 1 & 2							Port 3 & 4							
Inches From Port	Point#	Delta P Low	Delta P High	Delta P Average	Delta P Sq Root	Stack Temp (F)	Cyclonic Angle	Point#	Delta P Low	Delta P High	Delta P Average	Delta P Sq Root	Stack Temp (F)	Cyclonic Angle	
2.5	1	0.55	0.55	#DIV/0!	#DIV/0!	97.8	3.8	1	~~0.45~~ .28	~~0.45~~ .28	#DIV/0!	#DIV/0!	~~104.5~~ 103.5	~~1.8~~	2.6
5.0	2	0.70	0.70	#DIV/0!	#DIV/0!	107.7	4.8	2	~~.52~~	~~0.52~~ .31	#DIV/0!	#DIV/0!	105 105	~~2.0~~	3.2
7.5	3	0.75	0.75	#DIV/0!	#DIV/0!	109.1	3.0	3	.42 ~~0.60~~	.42 ~~0.60~~	#DIV/0!	#DIV/0!	107 107.1	~~0.5~~	3.6
10.0	4	0.80	0.80	#DIV/0!	#DIV/0!	108.6	2.6	4	0.42	0.42	#DIV/0!	#DIV/0!	108.1	2.8	
12.5	5	0.85	0.85	#DIV/0!	#DIV/0!	109.4	0.8	5	0.50	.50	#DIV/0!	#DIV/0!	107.1	2.8	
15.0	6	1.09	1.09	#DIV/0!	#DIV/0!	109.5	1.8	6	0.70	0.70	#DIV/0!	#DIV/0!	108.9	2.2	
17.5	7	1.3	1.3	#DIV/0!	#DIV/0!	109.6	0.5	7	0.91	0.91	#DIV/0!	#DIV/0!	109.1	2.6	
2.5	1	0.35	0.35	#DIV/0!	#DIV/0!	101.5	1.8	1	.45	.45	#DIV/0!	#DIV/0!	104.5	1.8	
5.0	2	0.38	0.38	#DIV/0!	#DIV/0!	104.8	3.0	2	.52	.52	#DIV/0!	#DIV/0!	105	2.0	
7.5	3	0.45	0.45	#DIV/0!	#DIV/0!	107.9	2.0	3	.60	.60	#DIV/0!	#DIV/0!	109	0.5	
10.0	4	0.38	0.38	#DIV/0!	#DIV/0!	108.6	1.2	4	.60	.60	#DIV/0!	#DIV/0!	109.1	3.6	
12.5	5	0.46	0.46	#DIV/0!	#DIV/0!	109.0	3.2	5	.40	.40	#DIV/0!	#DIV/0!	109.0	3.5	
15.0	6	0.60	0.60	#DIV/0!	#DIV/0!	109.1	4.5	6	.80	.80	#DIV/0!	#DIV/0!	108	5.2	
17.5	7	0.90	0.90	#DIV/0!	#DIV/0!	109.1	5.2	7	.85	.85	#DIV/0!	#DIV/0!	107.1	1.8	
										Average Values:	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	

*stack static pressure measured at 0.35" H_2O

*Pitot tube P-4-2 was leak checked @ 2" H_2O, max scale on the manometer

ECSI, INC. - VELOCITY TRAVERSE DATA

Client: Sterigenics
Location: Willowbrook - Plant 1
Source: AAT Safe Cell System Outlet

Run #: 1
Probe Type: Std.
Stack I.D.: 20x30
Date: ~~11/7/2017~~ 9/21/18
Baro Press: ~~29.96~~ 29.00
DSCFM:
Port Sketch:

0	0	0	0
1	2	3	4

Inches From Port	Port 1 & 2 Point#	Delta P Low	Delta P High	Delta P Average	Delta P Sq Root	Stack Temp (F)	Cyclonic Angle	Port 3 & 4 Point#	Delta P Low	Delta P High	Delta P Average	Delta P Sq Root	Stack Temp (F)	Cyclonic Angle	
2.5	1	0.55	0.55	#DIV/0!	#DIV/0!	97.8	3.8	1	~~0.45~~ .28	~~0.44~~ .28	#DIV/0!	#DIV/0!	~~104.5~~ 103.5	~~1.8~~	2.6
5.0	2	0.70	0.70	#DIV/0!	#DIV/0!	107.7	4.8	2	~~0.52~~ .31	~~0.52~~ .31	#DIV/0!	#DIV/0!	~~105~~ 105	~~2.0~~	2.2
7.5	3	0.75	0.75	#DIV/0!	#DIV/0!	109.1	3.0	3	~~0.60~~ .42	~~0.60~~ .42	#DIV/0!	#DIV/0!	~~107~~ 107.5	~~0.5~~	3.6
10.0	4	0.80	0.80	#DIV/0!	#DIV/0!	109.5 ~~109.0~~	2.6 ~~5~~	4	0.42	0.42	#DIV/0!	#DIV/0!	108.1	2.8	
12.5	5	0.85	0.85	#DIV/0!	#DIV/0!	109.4	0.8	5	0.50	.50	#DIV/0!	#DIV/0!	107.1	2.8	
15.0	6	1.09	1.09	#DIV/0!	#DIV/0!	109.5	1.8	6	0.70	0.70	#DIV/0!	#DIV/0!	108.9	2.2	
17.5	7	1.3	1.37	#DIV/0!	#DIV/0!	109.6	0.5	7	0.91	0.91	#DIV/0!	#DIV/0!	109.1	2.6	
2.5	1	0.35	.35	#DIV/0!	#DIV/0!	101.5	1.8	1	.45	.45	#DIV/0!	#DIV/0!	104.5	1.8	
5.0	2	0.38	0.38	#DIV/0!	#DIV/0!	104.8	3.0	2	.52	.52	#DIV/0!	#DIV/0!	105	2.0	
7.5	3	0.45	.45	#DIV/0!	#DIV/0!	107.9	2.0	3	.60	.60	#DIV/0!	#DIV/0!	109	0.5	
10.0	4	0.38	0.39	#DIV/0!	#DIV/0!	108.6	1.2	4	.40	.40	#DIV/0!	#DIV/0!	109.1	3.6	
12.5	5	0.46	0.46	#DIV/0!	#DIV/0!	109.0	3.2	5	.40	.40	#DIV/0!	#DIV/0!	109.0	3.5	
15.0	6	0.60	0.60	#DIV/0!	#DIV/0!	109.1	4.5	6	.80	.80	#DIV/0!	#DIV/0!	108	5.2	
17.5	7	0.90	0.90	#DIV/0!	#DIV/0!	109.1	5.2	7	.85	.85	#DIV/0!	#DIV/0!	107.1	1.8	
										Average Values:	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	

* Pitot tube P-42 was leak checked@2" H_2O, max scale on the manometer

WB1 Backvent Run#1 9/21/18

Inj	ΔP In/Out	Temp In/Out
1	.34/.62	104/104
2	.34/.62	104/104
3	.32/.62	104/104
4	.32/.60	104/104
5	.32/.60	104/104
6	.34/.60	104/104
7	.34/.60	103/103
8	.32/.62	104/104
9	.32/.60	103/103
10	.32/.60	104/104
11	.32/.60	104/104
12	.32/.61	104/104
13	.32/.61	104/104
14		
15		

WB.1 Backvent Run#2 9/21/18

Inj	ΔP In/out	Temp In/out
1	.34/.62	104/104
2	.34/.62	104/104
3	.32/.62	105/105
4	.34/.62	104/104
5	.32/.62	104/104
6	.34/.62	104/104
7	.34/.62	104/104
8	.34/.62	104/104
9	.32/.62	104/104
10	.32/.62	104/104
11	.32/.62	104/104
12	.32/.63	104/104
13	.32/.63	104/104
14		
15		

WB1 Backvent Run#3 9/21/18

Inj	ΔP In/out	Temp In/out
1	.32/.63	105/105
2	.34/.63	105/105
3	.32/.63	105/105
4	.32/.63	105/105
5	.32/.64	105/105
6	.32/.64	105/105
7	.32/.64	105/105
8	.33/.64	105/105
9	.32/.64	105/105
10	.32/.63	105/105
11	.32/.64	105/105
12	.32/.63	104/104
13		

(/)

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HISTORY (/HISTORY/DAILY/US/IL/CHICAGO-MIDWAY/KMDW/DATE/2018-10-16)

- TODAY (/WEATHER/US/IL/CHICAGO/KMDW)
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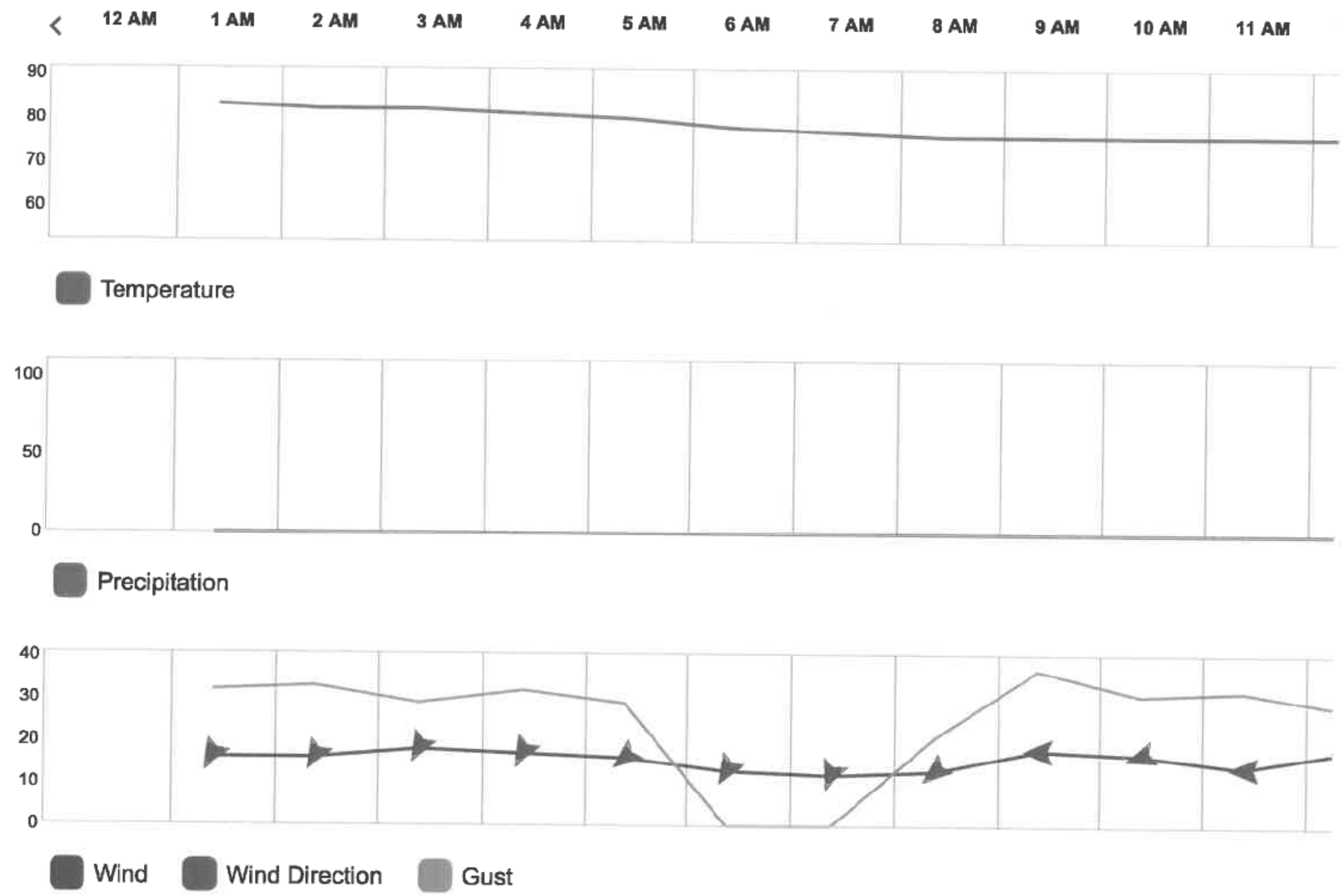
- WUNDERMAP (/WUNDERMAP?LAT=41.78583145&LON=-87.75222015)

Daily Weekly Monthly

September 21 2018 View



Summary

Temperature (° F)	Actual	Historic Avg.	Record
High Temp	83	73	95
Low Temp	58	55	40
Day Average Temp	71	64	-
Precipitation (Inches)	Actual	Historic Avg.	Record
Precipitation	1e-16	0.11	1.67
Month to Date	1.48	2.37	-
Year to Date	27.28	28.92	-
Degree Days (° F)	Actual	Historic Avg.	Record

Temperature (° F)	Actual	Historic Avg.	Record
Heating Degree Days	0	3	-
HDD Month to Date	0	35	-
HDD Since July 1	0	40	-
Cooling Degree Days	6	3	-
CDD Month to Date	196	103	-
CDD Year to Date	1361	1013	-
Growing Degree Days	20	-	-

Dew Point (° F)	Actual	Historic Avg.	Record
Dew Point	56	-	-
High	68	-	-
Low	41	-	-
Average	56	-	-

Wind (MPH)	Actual	Historic Avg.	Record
Max Wind Speed	28	-	-
Visibility	10	-	-

Sea Level Pressure (Hg)	Actual	Historic Avg.	Record
Sea Level Pressure	30.25	-	-

Astronomy	Day Length	Rise	Set
Actual Time	12h 13m	6:38 AM	6:52 PM
Civil Twilight		6:10 AM	7:19 PM
Nautical Twilight		5:38 AM	7:52 PM
Astronomical Twilight		5:04 AM	8:25 PM
Moon: waxing gibbous		5:29 PM	3:00 AM

Daily Observations

Time	Temperature	Dew Point	Humidity	Wind	Wind Speed	Wind Gust	Pressure	Precip.	Precip Accum
12:53 AM	83 ° F	67 ° F	58 %	SSW	16 mph	32 mph	29.1 in	0.0 in	0.0 in
1:53 AM	82 ° F	66 ° F	58 %	SSW	16 mph	33 mph	29.1 in	0.0 in	0.0 in
2:53 AM	82 ° F	65 ° F	56 %	SSW	18 mph	29 mph	29.1 in	0.0 in	0.0 in
3:53 AM	81 ° F	65 ° F	58 %	SSW	17 mph	32 mph	29.1 in	0.0 in	0.0 in
4:53 AM	80 ° F	66 ° F	62 %	SW	16 mph	29 mph	29.1 in	0.0 in	0.0 in
5:53 AM	78 ° F	67 ° F	68 %	SSW	13 mph	0 mph	29.1 in	0.0 in	0.0 in
6:53 AM	77 ° F	68 ° F	74 %	SSW	12 mph	0 mph	29.1 in	0.0 in	0.0 in
7:53 AM	76 ° F	68 ° F	76 %	SW	13 mph	21 mph	29.1 in	0.0 in	0.0 in
8:53 AM	76 ° F	62 ° F	62 %	W	18 mph	37 mph	29.2 in	0.0 in	0.0 in
9:53 AM	76 ° F	63 ° F	64 %	WSW	17 mph	31 mph	29.2 in	0.0 in	0.0 in
10:53 AM	76 ° F	62 ° F	62 %	W	14 mph	32 mph	29.2 in	0.0 in	0.0 in
11:53 AM	76 ° F	59 ° F	56 %	W	18 mph	28 mph	29.3 in	0.0 in	0.0 in
12:53 PM	76 ° F	56 ° F	50 %	W	21 mph	30 mph	29.3 in	0.0 in	0.0 in
1:53 PM	74 ° F	52 ° F	46 %	W	16 mph	29 mph	29.3 in	0.0 in	0.0 in
2:53 PM	75 ° F	51 ° F	43 %	WNW	18 mph	29 mph	29.3 in	0.0 in	0.0 in
3:53 PM	73 ° F	51 ° F	46 %	WNW	16 mph	26 mph	29.3 in	0.0 in	0.0 in
4:53 PM	71 ° F	50 ° F	47 %	NW	15 mph	0 mph	29.4 in	0.0 in	0.0 in
5:53 PM	69 ° F	48 ° F	47 %	NW	15 mph	0 mph	29.4 in	0.0 in	0.0 in
6:53 PM	68 ° F	48 ° F	49 %	NNW	16 mph	0 mph	29.4 in	0.0 in	0.0 in
7:53 PM	64 ° F	45 ° F	50 %	NNW	13 mph	24 mph	29.5 in	0.0 in	0.0 in
8:53 PM	63 ° F	45 ° F	52 %	NNW	15 mph	0 mph	29.5 in	0.0 in	0.0 in
9:53 PM	61 ° F	45 ° F	56 %	N	18 mph	26 mph	29.6 in	0.0 in	0.0 in
10:53 PM	59 ° F	41 ° F	51 %	N	9 mph	0 mph	29.6 in	0.0 in	0.0 in
11:53 PM	58 ° F	41 ° F	53 %	N	13 mph	0 mph	29.6 in	0.0 in	0.0 in

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APPENDIX G

Testing Equipment Information

CleanAir

CleanAir Instrument Rental
500 W. Wood Street
Palatine, IL 60067-4975
800-553-5511
www.cleanair.com

Pitot Tube Calibration

Probe Type: S-Type Pitot

I.D. Number: P-6-4
Project Number:

Thermocouple Calibration

Reference Type: Thermometer Reference I.D. No: 1641582Rg Pyrometer I.D. No: 80512890 Units: °F

Point No.	Target Temp.	Reference Temp.	Indicated Temp.	Temp. Difference	% Difference*	Within spec?
1	Ambient					
2	200°F-250°F					

* Based on Absolute Temperature (Rankine) %Difference ≤ 1.5

Geometric Pitot Calibration

Is pitot assembly in good repair? ◉Yes ○No If no, explain:

"S" Pitot

Dimensions		Dimensions		Specifications	Within Spec?
α1=	1.0	α2=	0.0	<=10 °	YES
β1=	2.0	β2=	2.0	<=5°	YES
γ=	0.0	θ=	0.0	None	N/A
A=	0.718			None	N/A
Dt=	0.250			0.1875"<=Dt<=0.375"	YES

	Calculations	Specifications	Within Spec?
A/2=Pa=Pb=	0.359 inches	None	N/A
Pa/Dt=Pb/Dt=	1.436 inches	1.05<P/Dt<1.5	YES
z = A sin γ =	0.000 inches	<=0.125"	YES
w = A sin θ =	0.000 inches	<=0.03125"	YES

Pitot Cp= **0.84 according to 40 CFR 60 section 10.1**

Standard Pitot

	Measurement	Specification	Calculation	Within Spec?
Tube O.D.		None		
Static Hole I.D.		within 10% of (0.1*O.D.)		
Tip to Static		>=6*O.D.		
Static to Bend		>=8*O.D.		

Pitot Cp=

Calibrated by: Wayne Berry

Date: 4/26/2018

CleanAir.

CleanAir Instrument Rental
500 W. Wood Street
Palatine, IL 60067-4975
800-553-5511
www.cleanair.com

Pitot Tube Calibration

Probe Type: S-Type Pitot

I.D. Number: P-4-2
Project Number:

Thermocouple Calibration

Reference Type: Thermometer Reference I.D. No: 1641582Rg Pyrometer I.D. No: 80512890 Units: °F

Point No.	Target Temp.	Reference Temp.	Indicated Temp.	Temp. Difference	% Difference*	Within spec?
1	Ambient					
2	200°F-250°F					

* Based on Absolute Temperature (Rankine) %Difference ≤ 1.5

Geometric Pitot Calibration

Is pitot assembly in good repair? (●) Yes ( ) No If no, explain:

"S" Pitot

Dimensions		Dimensions		Specifications	Within Spec?
α1=	1.0	α2=	1.0	<=10 °	YES
β1=	-1.0	β2=	2.0	<=5°	YES
γ=	3.0	θ=	0.0	None	N/A
A=	0.731			None	N/A
Dt=	0.250			0.1875"<=Dt<=0.375"	YES

	Calculations	Specifications	Within Spec?
A/2=Pa=Pb=	0.366 inches	None	N/A
Pa/Dt=Pb/Dt=	1.462 inches	1.05<P/Dt<1.5	YES
z = A sin γ =	0.038 inches	<=0.125"	YES
w = A sin θ =	0.000 inches	<=0.03125"	YES

Pitot Cp= **0.84 according to 40 CFR 60 section 10.1**

Standard Pitot

	Measurement	Specification	Calculation	Within Spec?
Tube O.D.	1.000 inches	None		N/A
Static Hole I.D.		within 10% of (0.1*O.D.)		
Tip to Static		>=6*O.D.		
Static to Bend		>=8*O.D.		

Pitot Cp=

Calibrated by: Wayne Berry

Date: 9/19/2018

Ulfig, Joseph

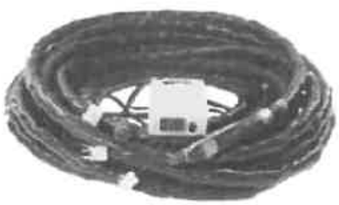
From:	Bill Graham <bgraham@cleanair.com>
Sent:	Wednesday, September 19, 2018 9:52 AM
To:	Ulfig, Joseph
Subject:	RE: Reference P-50998

Joe,
here is a cut sheet for heated lines directly from our Express Sales website. Sterigenics currently has one 0723-100 and one 0723-100HD.
the tubing is the same in both of them.

Regards,

Bill Graham Palatine Rental Team Leader
CleanAir Instrument Rental
500 W. Wood St. | Palatine, IL 60067
O: +1-800-553-5511 | rental.cleanair.com

HEATED SAMPLE LINES



These heated sample lines feature an electrically heat traced and insulated 3/8" Teflon ® PTFE (.030 Wall) sample line with a stainless steel over braid and stainless steel tube ends, a 1/4 Teflon ® PTFE (.040) calibration line, 3 pin Amphenol power connector, and 2 type K thermocouple plugs. Protected by a durable scuff resistant extruded polyurethane jacket. Temperature controller sold separately. *These Heated Sample Lines are not self limiting, a temperature controller is required.

HEATED SAMPLE LINES ARE USED WITH:

- CEM Cateco - 0035RNT
- CEM 3 Point Probe - 0723123
- Temperature Controllers

HEAVY DUTY VERSUS STANDARD HEATED SAMPLE LINE

- **Note: Heavy Duty Heated Sample Lines HD are manufactured to have a continuous operating temperature of 400°F (~204°C) at an ambient temperature of -20°F.**
- **Note: Standard Heated Sample Lines are manufactured to have a continuous operating temperature of 400°F (~204°C) at an ambient temperature of 0°F.**

HEATED SAMPLE LINE FEATURES:

- Rated for 400 ° F continuous operation at -20 ° F ambient temperature
- Triple insulation maintains temperature of line with less power consumption. **(Heavy Duty)**
- Lower resistance heaters requires less power to heat lines.
- A backup type K thermocouple to prevent project delays in the case of primary thermocouple failure in the field.
- Stainless steel over braid and stainless steel tube ends for the sample line to prevent abrasive failure in the field. Optional stainless steel over braid for protection of calibration line from abrasive failure in the field.
- Durable extruded poly-urethane jacket for protection of sample/calibration lines from abrasive failure in the field.
- Inert teflon ® PTFE sample and calibration lines will provide more accurate results by eliminating potential bias from other materials. Teflon is also more corrosion resistant than tygon, and can be washed with acetone without degradation.

Part Number	Voltage	Watts	Length FT	Amp.
0723-10	120	300	**10' Heated Sample Line**	2.73
0723-25	120	750	25' Heated Sample Line	6.82
0723-50	120	1500	50' Heated Sample Line	13.64
0723-100	120	2500	100' Heated Sample Line	22.73
*0723-100HD	120	3000	100' Heavy Duty Heated Sample Line	27
0723-100220	120/240	N/A	100' Dual Voltage Heated Sample Line	N/A
0725RENT	Universal Temperature Controller			

Custom lengths, voltage, and configuration available***Heavy Duty Heated Sample Lines are manufactured to have a continuous operating temperature of 400°F (~204°C) at -20°F ambient temperature.**These Heated Sample Lines may be rented through CleanAir Rental

FLIR Commercial Systems, Inc.
9 Townsend West
Nashua, NH 03063 USA
Telephone: 603.324.7600
1-800-GOINFRA

Certificate of Compliance

We hereby certify that to the best of our knowledge, the instruments listed below meet or exceed the specifications stated in the appropriate instruction manuals. FLIR Commercial Systems, Inc., an ISO 9001:2008 certified company, inspects its incoming shipments using an approved sampling plan with an AQL. All incoming inspections are performed using test equipment that is traceable to National Standards.

CUSTOMER: ECSI, INC.
MODEL #: EA10
SERIAL#: 171103433

Dated this day: 04/03/2018

APPENDIX H

Sample Line Residence Time

Sample Line Volume Calculation

Data: 100 ft of 3/8" Teflon line with wall thickness of .030"

Interior Volume Radius: (outside diameter/2) – (wall thickness) = (.375"/2) - .030" = 0.1575"

0.1575" * 1 ft/12 inches = 0.013125 feet

Cylindrical Volume = pi * r^2 * length = 3.1459 * $(0.013125)^2$ * 1 foot line length = 0.00054193 cubic feet per foot of line

0.00054193 cubic feet * 28316.8 cc / 1 cubic foot = 15.3457 cc per foot of line

For 100 foot of line, the total interior volume is 1535 cc.

Sample Residence Time Calculation

Sample Residence Time = Volume of sample lines / Sample pump flow rate

= 1535 cc / 500-1000 cc per minute = 1.54 - 3.07 minutes

APPENDIX I

Calibration Data

ETHYLENE OXIDE SOURCE TEST/CALIBRATION DATA

Client: Sterigenics-Willowbrook 1

Source Tested: AAT Safe Cell System

Date: 9/21/18

PRE CALIBRATION

Inlet (FID)	Calibration Gas Conc. (ppmv)	1.10 ppm EtO	10.1 ppm EtO	100 ppm EtO	1000 ppm EtO	10080 ppm EtO			
	Area Counts #1	.397	3.70	36.0					
	Area Counts #2/3	.396 .395	3.71 3.69	35.3 36.2					
	Average Area	.3960	3.700	35.80			Sample Line Bias Calibration		
	Audit Standard (48.8 ppmv) Result						(Std @ 100 ppmv)		
Outlet (PID)	Calibration Gas Conc. (ppmv) #4	1.10 ppm EtO 2.73	10.1 ppm EtO	100 ppm EtO					
	Area Counts #1	2.74	26.4	250					
	Area Counts #2/3	2.73 2.75	25.9 26.1	254 253					
	Average Area	2.740	26.13	252.3			Sample Line Bias Calibration		
	Audit Standard (48.8 ppmv) Result						(Std @ 10.1 ppmv)		

	Run #1	Run #2	Run #3
BV Start :	0913	0930	0952
BV Stop :	0928	0945	1007

P_{bar}: 28.95

$\%H_2O$:

EtO Usage (lbs/yr):

Cycles Per Week:

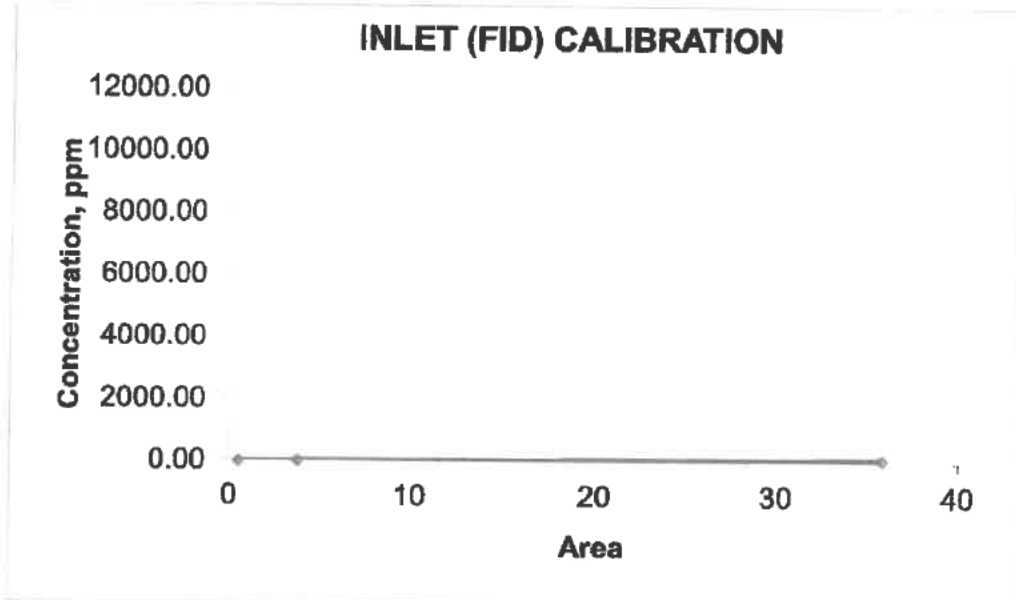
MID/POST CALIBRATION

Inlet (FID)	Calibration Gas Conc. (ppmv)	1.10 ppm EtO	10.1 ppm EtO	100 ppm EtO	1000 ppm EtO	10080 ppm EtO			
	~~Mid Cal~~								
	Post Cal			36.1	= 99.8	ppm	✓		
	Audit Standard (48.8 ppmv) Result								
Outlet (PID)	Calibration Gas Conc. (ppmv)	1.10 ppm EtO	10.1 ppm EtO	100 ppm EtO					
	~~Mid Cal~~								
	Post Cal		25.9	= 10.2	ppm	✓			
	Audit Standard (48.8 ppmv) Result								

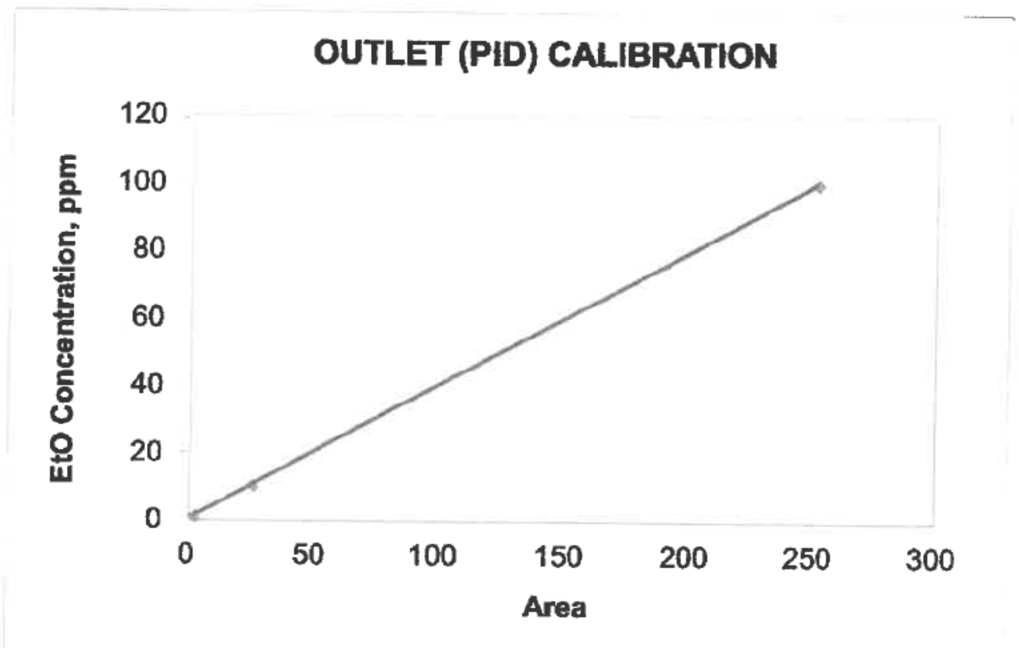
ECSi

EtO Calibrations

Site: Sterigenics - Willowbrook 1
Date: 9/21/2018



Slope 2.80
Intercept -0.08



Slope 0.397
Intercept -0.0770

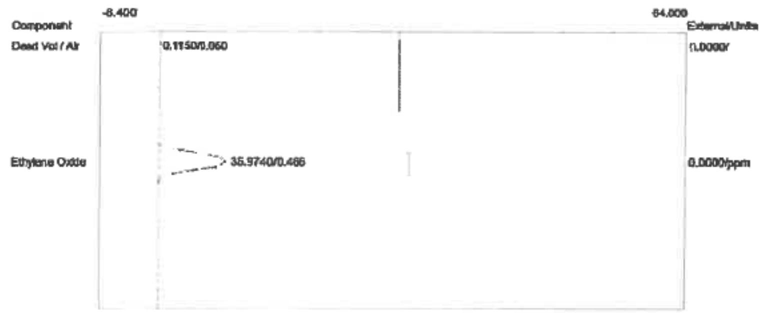
Lab name: ECSi
Client: Sterigenics - Willowbrook 1
Client ID: PreCal
Analysis date: 09/21/2018 05:02:52
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1Ster1WB2018-Amb.CHR (c:\peak359)
Sample: Ambient Background
Operator: D. Kremer

Component	Retention	Area	External	Units
Dead Vol / Air	0.233	7.0840	0.0000	
		7.0840	0.0000	

Lab name: ECSi
Client: Sterigenics - Willowbrook 1
Client ID: PreCal
Analysis date: 09/21/2018 05:02:52
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2Ster1WB2018-Amb.CHR (c:\peak359)
Sample: Ambient Background
Operator: D. Kremer

Component	Retention	Area	External	Units
Dead Vol / Air	0.100	38.7340	0.0000	
		38.7340	0.0000	

Lab name: ECSI
Client: Sterigenics - Willowbrook 1
Client ID: PreCal
Analysis date: 09/21/2018 05:14:01
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1Ster1WB2018-C01.CHR (c:\peak359)
Sample: 100 ppm std
Operator: D. Kremer



Component	Retention	Area	External	Units
Dead Vol / Air	0.050	0.1150	0.0000	
Ethylene Oxide	0.466	35.9740	0.0000	ppm
		36.0890	0.0000	

Lab name: ECSI
Client: Sterigenics - Willowbrook 1
Client ID: PreCal
Analysis date: 09/21/2018 05:14:01
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2Ster1WB2018-C01.CHR (c:\peak359)
Sample: 100 ppm Std
Operator: D. Kremer

Component	Retention	Area	External	Units
Dead Vol / Air	0.066	2.8880	0.0000	
Ethylene Oxide	0.483	250.3980	0.0000	ppm
		253.2860	0.0000	

Lab name: ECSi
Client: Sterigenics - Willowbrook 1
Client ID: PreCal
Analysis date: 09/21/2018 05:17:09
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1Ster1WB2018-C02.CHR (c:\peak359)
Sample: 100 ppm std
Operator: D. Kremer

Component	Retention	Area	External	Units
Ethylene Oxide	0.466	35.2280	0.0000	ppm
		35.2280	0.0000	

Lab name: ECSi
Client: Sterigenics - Willowbrook 1
Client ID: PreCal
Analysis date: 09/21/2018 05:17:09
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2Ster1WB2018-C02.CHR (c:\peak359)
Sample: 100 ppm Std
Operator: D. Kremer

Component	Retention	Area	External	Units
Dead Vol / Air	0.283	1.1260	0.0000	
Ethylene Oxide	0.500	253.5895	0.0000	ppm
		254.7155	0.0000	

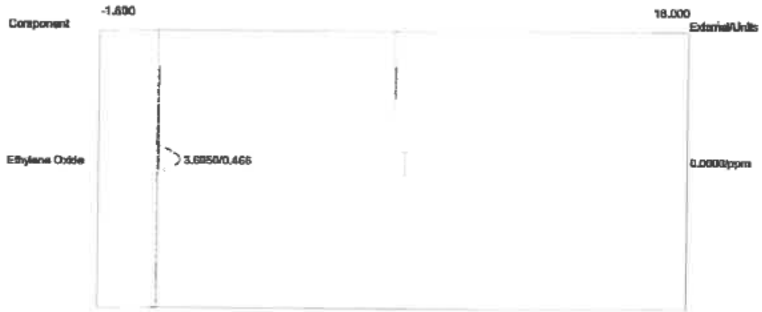
Lab name: ECSi
Client: Sterigenics - Willowbrook 1
Client ID: PreCal
Analysis date: 09/21/2018 05:19:40
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1Ster1WB2018-C03.CHR (c:\peak359)
Sample: 100 ppm std
Operator: D. Kremer

Component	Retention	Area	External	Units
Dead Vol / Air	0.066	0.1230	0.0000	
Ethylene Oxide	0.466	36.2430	0.0000	ppm
		36.3660	0.0000	

Lab name: ECSi
Client: Sterigenics - Willowbrook 1
Client ID: PreCal
Analysis date: 09/21/2018 05:19:40
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2Ster1WB2018-C03.CHR (c:\peak359)
Sample: 100 ppm Std
Operator: D. Kremer

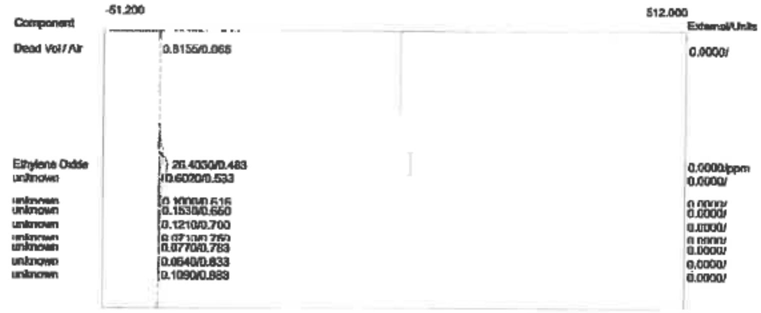
Component	Retention	Area	External	Units
Dead Vol / Air	0.266	1.2750	0.0000	
Ethylene Oxide	0.483	253.1490	0.0000	ppm
		254.4240	0.0000	

Lab name: ECSi
Client: Sterigenics - Willowbrook 1
Client ID: PreCal
Analysis date: 09/21/2018 05:21:40
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1Ster1WB2018-C04.CHR (c:\peak359)
Sample: 10.1 ppm std
Operator: D. Kremer



Component	Retention	Area	External	Units
Ethylene Oxide	0.466	3.6950	0.0000	ppm
		3.6950	0.0000	

Lab name: ECSi
Client: Sterigenics - Willowbrook 1
Client ID: PreCal
Analysis date: 09/21/2018 05:21:40
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2Ster1WB2018-C04.CHR (c:\peak359)
Sample: 10.1 ppm std
Operator: D. Kremer



Component	Retention	Area	External	Units
Dead Vol / Air	0.068	0.8155	0.0000	
Ethylene Oxide	0.483	26.4030	0.0000	ppm
		27.2185	0.0000	

Lab name: ECSi
Client: Sterigenics - Willowbrook 1
Client ID: PreCal
Analysis date: 09/21/2018 05:26:02
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1Ster1WB2018-C05.CHR (c:\peak359)
Sample: 10.1 ppm std
Operator: D. Kremer

Component	Retention	Area	External	Units
Ethylene Oxide	0.466	3.7130	0.0000	ppm
		3.7130	0.0000	

Lab name: ECSi
Client: Sterigenics - Willowbrook 1
Client ID: PreCal
Analysis date: 09/21/2018 05:26:02
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2Ster1WB2018-C05.CHR (c:\peak359)
Sample: 10.1 ppm std
Operator: D. Kremer

Component	Retention	Area	External	Units
Dead Vol / Air	0.100	2.5705	0.0000	
Ethylene Oxide	0.500	25.9090	0.0000	ppm
		28.4795	0.0000	

Lab name: ECSi
Client: Sterigenics - Willowbrook 1
Client ID: PreCal
Analysis date: 09/21/2018 05:30:06
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1Ster1WB2018-C06.CHR (c:\peak359)
Sample: 10.1 ppm std
Operator: D. Kremer

Component	Retention	Area	External	Units
Ethylene Oxide	0.450	3.6870	0.0000	ppm
		3.6870	0.0000	

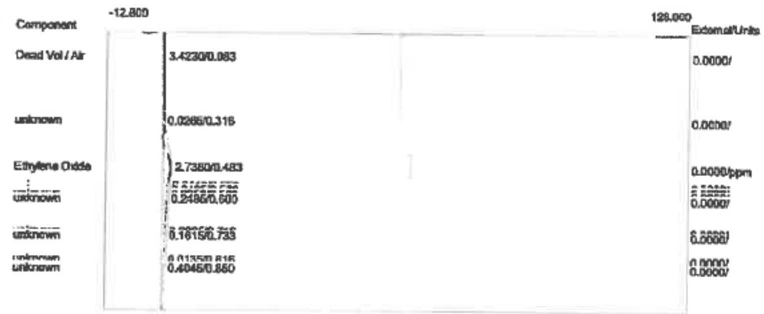
Lab name: ECSi
Client: Sterigenics - Willowbrook 1
Client ID: PreCal
Analysis date: 09/21/2018 05:30:06
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2Ster1WB2018-C06.CHR (c:\peak359)
Sample: 10.1 ppm std
Operator: D. Kremer

Component	Retention	Area	External	Units
Dead Vol / Air	0.066	4.9475	0.0000	
Ethylene Oxide	0.483	26.0620	0.0000	ppm
		31.0095	0.0000	

Lab name: ECSi
Client: Sterigenics - Willowbrook 1
Client ID: PreCal
Analysis date: 09/21/2018 05:35:21
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1Ster1WB2018-C07.CHR (c:\peak359)
Sample: ~~10.4~~ ppm std 1.10
Operator: D. Kremer

Component	Retention	Area	External	Units
Dead Vol / Air	0.066	0.1780	0.0000	
Ethylene Oxide	0.450	0.3970	0.0000	ppm
		0.5750	0.0000	

Lab name: ECSi
Client: Sterigenics - Willowbrook 1
Client ID: PreCal
Analysis date: 09/21/2018 05:35:21
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2Ster1WB2018-C07.CHR (c:\peak359)
Sample: ~~10.4~~ ppm std 1.10
Operator: D. Kremer



Component	Retention	Area	External	Units
Dead Vol / Air	0.083	3.4230	0.0000	
Ethylene Oxide	0.483	2.7380	0.0000	ppm
		6.1610	0.0000	

Lab name: ECSi
Client: Sterigenics - Willowbrook 1
Client ID: PreCal
Analysis date: 09/21/2018 05:42:38
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1Ster1WB2018-C08.CHR (c:\peak359)
Sample: ~~10.1~~ ppm std 1.10
Operator: D. Kremer

Component	Retention	Area	External	Units
Dead Vol / Air	0.083	0.3760	0.0000	
Ethylene Oxide	0.466	0.3955	0.0000	ppm
		0.7715	0.0000	

Lab name: ECSi
Client: Sterigenics - Willowbrook 1
Client ID: PreCal
Analysis date: 09/21/2018 05:42:38
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2Ster1WB2018-C08.CHR (c:\peak359)
Sample: ~~10.1~~ ppm std 1.10
Operator: D. Kremer

Component	Retention	Area	External	Units
Dead Vol / Air	0.083	3.3910	0.0000	
Ethylene Oxide	0.500	2.7285	0.0000	ppm
		6.1195	0.0000	

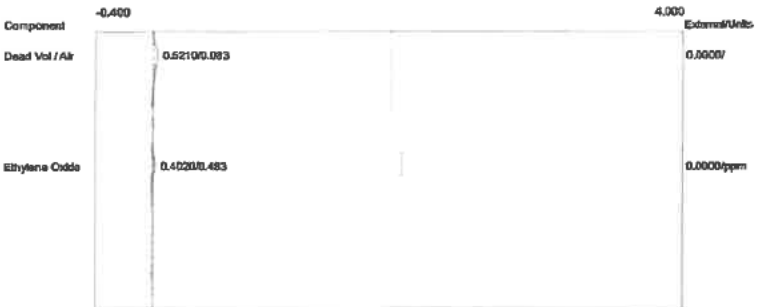
Lab name: ECSi
Client: Sterigenics - Willowbrook 1
Client ID: PreCal
Analysis date: 09/21/2018 05:52:32
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1Ster1WB2018-C09.CHR (c:\peak359)
Sample: ~~10.1~~ ppm std 1.10
Operator: D. Kremer

Component	Retention	Area	External	Units
Dead Vol / Air	0.100	0.1280	0.0000	
Ethylene Oxide	0.466	0.3945	0.0000	ppm
		0.5225	0.0000	

Lab name: ECSi
Client: Sterigenics - Willowbrook 1
Client ID: PreCal
Analysis date: 09/21/2018 05:52:32
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2Ster1WB2018-C09.CHR (c:\peak359)
Sample: ~~10.1~~ ppm std 1.10
Operator: D. Kremer

Component	Retention	Area	External	Units
Dead Vol / Air	0.083	2.8105	0.0000	
Ethylene Oxide	0.500	2.7540	0.0000	ppm
		5.5645	0.0000	

Lab name: ECSi
Client: Sterigenics - Willowbrook 1
Client ID: PreCal
Analysis date: 09/21/2018 05:59:13
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1Ster1WB2018-4C.CHR (c:\peak359)
Sample: ~~10.1~~ ppm std 1.10
Operator: D. Kremer



Component	Retention	Area	External	Units
Dead Vol / Air	0.083	0.5210	0.0000	
Ethylene Oxide	0.483	0.4020	0.0000	ppm
		0.9230	0.0000	

Lab name: ECSi
Client: Sterigenics - Willowbrook 1
Client ID: PreCal
Analysis date: 09/21/2018 05:59:13
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2Ster1WB2018-4C.CHR (c:\peak359)
Sample: ~~10.1~~ ppm std 1.10
Operator: D. Kremer

Component	Retention	Area	External	Units
Dead Vol / Air	0.100	1.9020	0.0000	
Ethylene Oxide	0.516	2.7290	0.0000	ppm
		4.6310	0.0000	

Lab name: ECSi
Client: Sterigenics - Willowbrook 1
Client ID: PreCal
Analysis date: 09/21/2018 06:08:35
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1Ster1WB2018-Audit.CHR (c:\peak359)
Sample: 48.8 ppm audit std
Operator: D. Kremer

Component	Retention	Area	External	Units
Dead Vol / Air	0.050	0.1105	0.0000	
Ethylene Oxide	0.466	17.4080	48.1622	ppm
		17.5185	48.1622	

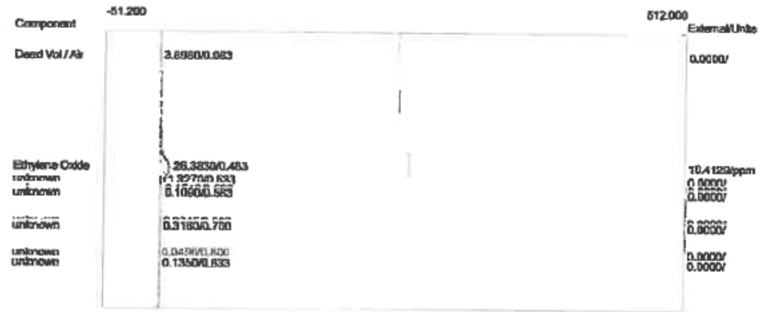
Lab name: ECSI
Client: Sterigenics - Willowbrook 1
Client ID: PreCal
Analysis date: 09/21/2018 06:08:35
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2Ster1WB2018-Audit.CHR (c:\peak359)
Sample: 48.8 ppm audit std
Operator: D. Kremer

Component	Retention	Area	External	Units
Dead Vol / Air	0.066	0.9790	0.0000	
Ethylene Oxide	0.483	122.7760	48.4576	ppm
		123.7550	48.4576	

Lab name: ECSi
Client: Sterigenics - Willowbrook 1
Client ID: PreCal
Analysis date: 09/21/2018 06:15:37
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1Ster1WB2018-C10.CHR (c:\peak359)
Sample: 100 ppm std sample line bias
Operator: D. Kremer

Component	Retention	Area	External	Units
Dead Vol / Air	0.066	0.4660	0.0000	
Ethylene Oxide	0.466	35.8985	99.3192	ppm
		36.3645	99.3192	

Lab name: ECSi
Client: Sterigenics - Willowbrook 1
Client ID: PreCal
Analysis date: 09/21/2018 06:20:23
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2Ster1WB2018-C11.CHR (c:\peak359)
Sample: 10.1 ppm std sample line bias
Operator: D. Kremer

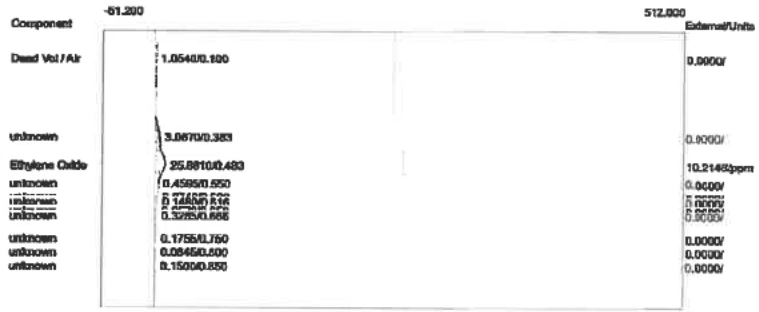


Component	Retention	Area	External	Units
Dead Vol / Air	0.083	3.8980	0.0000	
Ethylene Oxide	0.483	26.3830	10.4129	ppm
		30.2810	10.4129	

Lab name: ECSi
Client: Sterigenics - Willowbrook 1
Client ID: PostCal
Analysis date: 09/21/2018 11:01:28
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1Ster1WB2018-C11.CHR (c:\peak359)
Sample: 100 ppm std
Operator: D. Kremer

Component	Retention	Area	External	Units
Dead Vol / Air	0.066	0.2175	0.0000	
Ethylene Oxide	0.466	36.0880	99.8435	ppm
		36.3055	99.8435	

Lab name: ECSi
Client: Sterigenics - Willowbrook 1
Client ID: PostCal
Analysis date: 09/21/2018 11:06:36
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2Ster1WB2018-C12.CHR (c:\peak359)
Sample: 10.1 ppm std
Operator: D. Kremer



Component	Retention	Area	External	Units
Dead Vol / Air	0.100	1.0540	0.0000	
Ethylene Oxide	0.483	25.8810	10.2148	ppm
		26.9350	10.2148	

Lab name: ECSi
Client: Sterigenics - Willowbrook 1
Client ID: PostCal
Analysis date: 09/24/2018 19:35:07
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1SterWB2018-C01.CHR (c:\peak359)
Sample: 1000 ppm std
Operator: D. Kremer

Component	Retention	Area	External	Units
:thylene Oxide	0.500	360.7670	998.1227	ppm
		360.7670	998.1227	

* 1000ppm std run post-test using calibration curve
from test to demonstrate linearity @ 100-1000 ppm,
this chromatogram is 1/3

Lab name: ECSI
Client: Sterigenics - Willowbrook 1
Client ID: PostCal
Analysis date: 09/24/2018 19:37:34
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1SterWB2018-C02.CHR (c:\peak359)
Sample: 1000 ppm std
Operator: D. Kremer

Component	Retention	Area	External	Units
ead Vol / Air	0.066	0.3905	0.0000	
thylene Oxide	0.483	361.0890	999.0136	ppm
		361.4795	999.0136	

2/3

Lab name: ECSi
Client: Sterigenics - Willowbrook 1
Client ID: PostCal
Analysis date: 09/24/2018 19:39:26
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1SterWB2018-C03.CHR (c:\peak359)
Sample: 1000 ppm std
Operator: D. Kremer

Component	Retention	Area	External	Units
)ead Vol / Air	0.066	0.5490	0.0000	
:thylene Oxide	0.483	360.7760	998.1476	ppm
		361.3250	998.1476	

3/3

APPENDIX J

Gas Certifications

CERTIFIED WORKING CLASS

Single-Certified Calibration Standard

Scott Specialty Gases
500 CAJON BLVD., SAN BERNARDINO, CA 92411
Phone: 909-887-2571 Fax: 909-887-0549

CERTIFICATE OF ACCURACY: Certified Working Class Calibration Standard

Product Information
Project No.: 02-57164-001
Item No.: 02020001310TCL
P.O. No.: VBL – D. KREMER

Cylinder Number: CAL4448
Cylinder Size: CL
Certification Date: 20Apr2018

Customer

ECSI, INC
PO BOX 1498
SAN CLEMENTE, CA 92674

CERTIFIED CONCENTRATION

Component Name	Concentration (Moles)		Accuracy (+/-%)
ETHYLENE OXIDE	1.10	PPM	5
NITROGEN		BALANCE	

TRACEABILITY

Traceable To

Scott Reference Standard

APPROVED BY: MT MT

DATE: 4-20-18

SPECIFICATIONS

Component Name	Requested Concentration (Moles)		Certified Concentration (Moles)		Blend Tolerance Result (+/- %)	Certified Accuracy Result (+/- %)
ETHYLENE OXIDE	1.	PPM	1.10	PPM	10.0	5.00
NITROGEN		BAL		BAL		

TRACEABILITY

Traceable To
Scott Reference Standard

PHYSICAL PROPERTIES

Cylinder Size: CL

Pressure: 1200 PSIG
Expiration Date: 20Apr2020

SPECIAL HANDLING INSTRUCTIONS

Do not use or store cylinder at or below the stated dew point temperature. Possible condensation of heavier components could result. In the event the cylinder has been exposed to temperatures at or below the dew point, place cylinder in heated area for 24 hours and then roll cylinder for 15 minutes to re-mix.

Use of calibration standards at or below dew point temperature may result in calibration error.

COMMENTS

Scott Specialty Gases
00 CAJON BLVD., SAN BERNARDINO, CA 92411

CERTIFIED WORKING CLASS

Single-Certified Calibration Standard

Phone: 909-887-2571 Fax: 909-887-0549

CERTIFICATE OF ACCURACY: Certified Working Class Calibration Standard

Product Information
Project No.: 02-57164-003
Item No.: 02020001320TCL
P.O. No.: VBL – D. KREMER

Cylinder Number: CLM003232
Cylinder Size: CL
Certification Date: 20Apr2018

Customer

ECSI, INC
PO BOX 1498
SAN CLEMENTE, CA 92674

CERTIFIED CONCENTRATION

Component Name	Concentration (Moles)		Accuracy (+/-%)
ETHYLENE OXIDE	10.1	PPM	5
NITROGEN		BALANCE	

TRACEABILITY

Traceable To

Scott Reference Standard

APPROVED BY: MT (signature) MT

DATE: 4-20-18

SPECIFICATIONS

Component Name	Requested Concentration (Moles)		Certified Concentration (Moles)		Blend Tolerance Result (+/- %)	Certified Accuracy Result (+/- %)
ETHYLENE OXIDE	10.	PPM	10.1	PPM	1.0	5.00
NITROGEN		BAL		BAL		

TRACEABILITY

Traceable To
Scott Reference Standard

PHYSICAL PROPERTIES

Cylinder Size: CL

Pressure: 1200 PSIG
Expiration Date: 20Apr2020

SPECIAL HANDLING INSTRUCTIONS

Do not use or store cylinder at or below the stated dew point temperature. Possible condensation of heavier components could result. In the event the cylinder has been exposed to temperatures at or below the dew point, place cylinder in heated area for 24 hours and then roll cylinder for 15 minutes to re-mix.

Use of calibration standards at or below dew point temperature may result in calibration error.

COMMENTS

CERTIFIED WORKING CLASS

Single-Certified Calibration Standard

Scott Specialty Gases
00 CAJON BLVD., SAN BERNARDINO, CA 92411
Phone: 909-887-2571 Fax: 909-887-0549

CERTIFICATE OF ACCURACY: Certified Working Class Calibration Standard

Product Information
Project No.: 02-57164-004
Item No.: 02020001330TCL
P.O. No.: VBL – D. KREMER

Cylinder Number: CLM011385
Cylinder Size: CL
Certification Date: 20Apr2018

Customer

ECSI, INC
PO BOX 1498
SAN CLEMENTE, CA 92674

CERTIFIED CONCENTRATION

Component Name	Concentration (Moles)		Accuracy (+/-%)
ETHYLENE OXIDE	100.	PPM	5
NITROGEN		BALANCE	

TRACEABILITY

Traceable To

Scott Reference Standard

APPROVED BY: B. McCully BLM

DATE: 4-20-18

SPECIFICATIONS

Component Name	Requested Concentration (Moles)		Certified Concentration (Moles)		Blend Tolerance Result (+/- %)	Certified Accuracy Result (+/- %)
ETHYLENE OXIDE	100.	PPM	100.	PPM	.0	5.00
NITROGEN		BAL		BAL		

TRACEABILITY

Traceable To
Scott Reference Standard

PHYSICAL PROPERTIES

Cylinder Size: CL

Pressure: 1300 PSIG
Expiration Date: 20Apr2020

Valve Connection: CGA 350

SPECIAL HANDLING INSTRUCTIONS

Do not use or store cylinder at or below the stated dew point temperature. Possible condensation of heavier components could result. In the event the cylinder has been exposed to temperatures at or below the dew point, place cylinder in heated area for 24 hours and then roll cylinder for 15 minutes to re-mix.

Use of calibration standards at or below dew point temperature may result in calibration error.

COMMENTS

CERTIFIED WORKING CLASS

Single-Certified Calibration Standard

Scott Specialty Gases

500 CAJON BLVD., SAN BERNARDINO, CA 92411

Phone: 909-887-2571 Fax: 909-887-0549

CERTIFICATE OF ACCURACY: Certified Working Class Calibration Standard

Product Information
Project No.: 02-57164-005
Item No.: 02020001340TCL
P.O. No.: VBL – D. KREMER

Cylinder Number: CLM002810
Cylinder Size: CL
Certification Date: 20Apr2018

Customer

ECSI, INC
PO BOX 1498
SAN CLEMENTE, CA 92674

CERTIFIED CONCENTRATION

Component Name	Concentration (Moles)		Accuracy (+/-%)
ETHYLENE OXIDE	1,000.	PPM	5
NITROGEN		BALANCE	

TRACEABILITY

Traceable To

Scott Reference Standard

APPROVED BY: B. McCall

BLM

DATE: 4-20-18

SPECIFICATIONS

Component Name	Requested Concentration (Moles)		Certified Concentration (Moles)		Blend Tolerance Result (+/- %)	Certified Accuracy Result (+/- %)
ETHYLENE OXIDE	1,000.	PPM	1,000.	PPM	.0	5.00
NITROGEN		BAL		BAL		

TRACEABILITY

Traceable To
Scott Reference Standard

PHYSICAL PROPERTIES

Cylinder Size: CL

Pressure: 1200 PSIG
Expiration Date: 20Apr2020

Valve Connection: CGA 350

SPECIAL HANDLING INSTRUCTIONS

Do not use or store cylinder at or below the stated dew point temperature. Possible condensation of heavier components could result. In the event the cylinder has been exposed to temperatures at or below the dew point, place cylinder in heated area for 24 hours and then roll cylinder for 15 minutes to re-mix.

Use of calibration standards at or below dew point temperature may result in calibration error.

COMMENTS

CERTIFIED WORKING CLASS

Single-Certified Calibration Standard

Scott Specialty Gases

00 CAJON BLVD., SAN BERNARDINO, CA 92411

Phone: 909-887-2571 Fax: 909-887-0549

CERTIFICATE OF ACCURACY: Certified Working Class Calibration Standard

Product Information
Project No.: 02-57164-006
Item No.: 02020001340TCL
P.O. No.: VBL – D. KREMER

Cylinder Number: CLM005787
Cylinder Size: CL
Certification Date: 20Apr2018

Customer

ECSI, INC
PO BOX 1498
SAN CLEMENTE, CA 92674

CERTIFIED CONCENTRATION

Component Name	Concentration (Moles)		Accuracy (+/-%)
ETHYLENE OXIDE	10,080.	PPM	5
NITROGEN		BALANCE	

TRACEABILITY

Traceable To

Scott Reference Standard

APPROVED BY: B. McCully
BLM

DATE: 4-20-18

SPECIFICATIONS

Component Name	Requested Concentration (Moles)		Certified Concentration (Moles)		Blend Tolerance Result (+/- %)	Certified Accuracy Result (+/- %)
ETHYLENE OXIDE	10,000.	PPM	10,080.	PPM	.8	5.00
NITROGEN		BAL		BAL		

TRACEABILITY

Traceable To
Scott Reference Standard

PHYSICAL PROPERTIES

Cylinder Size: CL

Pressure: 700 PSIG
Expiration Date: 20Apr2020

Valve Connection: CGA 350

SPECIAL HANDLING INSTRUCTIONS

Do not use or store cylinder at or below the stated dew point temperature. Possible condensation of heavier components could result. In the event the cylinder has been exposed to temperatures at or below the dew point, place cylinder in heated area for 24 hours and then roll cylinder for 15 minutes to re-mix.

Use of calibration standards at or below dew point temperature may result in calibration error.

COMMENTS

MESA

CERTIFICATE OF ANALYSIS

Customer Name:	BCSi, Inc.	**Cylinder Number:**	SA25925
Stock or Analyzer Tag Number:	N/A	**Product Class:**	Certified Standard
Customer Reference:	Verbal- Dan	**Cylinder - Contents[1]:**	28 CF @ 2000 PSI
MESA Reference:	104448	**Cylinder-CGA:**	A006-HP-BR/350
Date of Certification:	4/19/2018	**Analysis Method:**	GC-TCD/FID
Recommended Shelf Life:	2 Years	**Preparation Method:**	Gravimetric

Component	**Requested Concentration[2]**	**Reported Concentration[2,3]**
Ethylene Oxide	50 ppm	48.8 ppm
Nitrogen	Balance	Balance

Authorized Signature:

1. The fill pressure shown on the COA is as originally quoted. The fill pressure measured by the customer may differ from the fill pressure originally quoted due to temperature effects, compressibility of the individual components when blended together in the cylinder, gauge accuracy or reduction in content volume before shipping as a result of samples withdrawn for laboratory QC necessary to ensure product quality.
2. Unless otherwise stated, concentrations are given in molar units.
3. Vapor pressure mixes are blended at a sufficiently low pressure so as to eliminate phase separation under most low temperature conditions encountered during transport or storage. However, it is generally recommended that cylinders containing vapor pressure restricted mixes be placed on the floor in a horizontal position and rolled back and forth to improve homogeneity of the gas phase mixture before being put into service.

Analytical Gas Standards are prepared and analyzed using combinations of NIST traceable weights, SRM's provided by NIST, or internal gas standards that have been verified for accuracy using procedures published by the US-EPA. Pure gases are analyzed and certified for purity using minor component Analytical Gas Standards prepared according to the methods specified above. Balances are calibrated to NIST test weights covered by NIST test number 822/256175/96. Reference Certification #'s: 163/W, 830/N and 3280. Calibration methods are in conformance with MIL-STD 45662A.

MESA Specialty Gases & Equipment
division of MESA International Technologies, Inc.
3619 Pendleton Avenue, Suite C ◆ Santa Ana, California 92704 ◆ USA
TEL: 714-434-7102 ◆ FAX: 714-434-8006 ◆ E-mail: mail@mesagas.com
On-line Catalog at www.mesagas.com

APPENDIX K

Limit of Detection

ECSi

Detection Limit Study

Step 1 : Prepare and analyze at least seven standards prepared at or near the estimated detection limit

Step 2 : Record and calculate the standard deviation of the replicate measurements.

Analysis Number	1	2	3	4	5	6	7	8	9	10
Result	1.007	1.011	1.015	1.01	1.071	1.071	1.067			

Calculated Standard Deviation = 0.0316

Step 3 : Determine the Method Detection Limit (MDL) by mulitplying the student T value appropriate for 99% confidence level and the standard deviation estimate with in n-1 degrees of freedom

Number of Replicates	7	8	9	10
T-values	3.143	2.998	2.896	2.821

Method Detection Limit: = 0.10

Wagner, Kevin

From: Hoffman, Kathy
Sent: Tuesday, September 25, 2018 8:42 AM
To: Wagner, Kevin
Subject: FW: MDL calculations and additional information.
Attachments: Detection Limit Master Spreadsheet.xls

From: Shappley, Ned [mailto:Shappley.Ned@epa.gov]
Sent: Monday, September 24, 2018 12:02 PM
To: Hoffman, Kathy; dankremer@ecsi1.com
Cc: Sieffert, Margaret; Mattison, Kevin; Merrill, Raymond; Johnson, Steffan
Subject: MDL calculations and additional information.

Dan/Kathy,

As we discussed on site, attached is the spreadsheet (Note, this is not an official EPA spreadsheet) I used to determine the MDL (i.e., LOD) for the testing last week at Sterigenics. It is important to include all raw data associated with this study as well as a discussion of the procedures used. The reference for how MDL studies should be performed can be found in Section 15.2 of Method 301 (40 CFR Part 63), which links you to 40 CFR Part 136, Appendix B (see below). In this instance, I am making the recommendation to Illinois EPA to accept this MDL study with just spiked samples and collected over a shorter time period.

Based on the 7 replicate values I calculated using the low calibration response, in lieu of reporting a ND, you should report a <0.10 ppm for the measured concentration. It is important to use this MDL value when calculating the DRE. Going forward you should consider repeating the MDL for each test program or include a MDL verification step to ensure that your system is capable of measuring at these low-levels. For future MDL studies, it is strongly suggested you develop an MDL using a similar matrix (i.e., in air) as opposed to a calibration gas cylinder. I suggest filling a Tedlar bag with carbon-free air and injecting a concentration of EtO into the bag targeting a concentration in the Tedlar Bag of approximately 0.3 to 0.5 ppm. This type of evaluation would best replicate the sample matrix as measured by the GC.

Additional Information:

Going forward, it is important to use the procedures that were utilized during the Sterigenics for future tests, making sure to 1) verify the sampling testing locations meet all Method 1 criteria, 2) performing all required velocity traverses as required by the method, 3) use of heated sampling system (Method 18 – Section 8.2.2.1.1 and 8.2.2.1.2) to prevent moisture or organic condensation, 4) perform a successful recovery study for direct interface sampling (Method 18 – Section 8.4.1) to verify the efficacy of the sampling system, and 5) to select calibration standards that bracket the sample concentrations (Method 18 – Section 8.2.4.3). These are not recommendations, they are requirements of the method and failure to follow these procedures could be grounds for a regulatory authority to invalidate a test.

Please let me know if you have any questions,

Ned Shappley

40 CFR Part 136, Appendix B

....

(a) Select a spiking level, typically 2—10 times the estimated MDL in Section 1. Spiking levels in excess of 10 times the estimated detection limit may be required for analytes with very poor recovery (e.g., for an analyte with 10% recovery, spiked at 100 micrograms/L, with mean recovery of 10 micrograms/L; the calculated MDL may be around 3 micrograms/L. Therefore, in this example, the spiking level would be 33 times the MDL, but spiking lower may result in no recovery at all).

(b) Process a minimum of seven spiked samples and seven method blank samples through all steps of the method. The samples used for the MDL must be prepared in at least three batches on three separate calendar dates and analyzed on three separate calendar dates. (Preparation and analysis may be on the same day.) Existing data may be used, if compliant with the requirements for at least three batches, and generated within the last twenty four months. The most recent available data for method blanks and spiked samples must be used. Statistical outlier removal procedures should not be used to remove data for the initial MDL determination, since the total number of observations is small and the purpose of the MDL procedure is to capture routine method variability. However, documented instances of gross failures (e.g., instrument malfunctions, mislabeled samples, cracked vials) may be excluded from the calculations, provided that at least seven spiked samples and seven method blanks are available. (The rationale for removal of specific outliers must be documented and maintained on file with the results of the MDL determination.)

......

(ii) Compute the MDL_s (the MDL based on spiked samples) as follows:

$MDL_S = t_{(n-1,\, 1-\alpha = 0.99)} S_s$

Where:

MDL_s = the method detection limit based on spiked samples

$t_{(n-1,\, 1-\alpha = 0.99)}$ = the Student's t-value appropriate for a single-tailed 99th percentile t statistic and a standard deviation estimate with n-1 degrees of freedom. See Addendum Table 1.

S_s = sample standard deviation of the replicate spiked sample analyses.

Ned Shappley | USEPA|OAQPS|AQAD|Measurement Technology Group
109 TW Alexander Drive (E143-02) | Research Triangle Park, NC 27711
email: shappley.ned@epa.gov | Phone (919)541-7903

APPENDIX L

Permits/Protocols

ECSi

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

1021 NORTH GRAND AVENUE EAST, P.O. BOX 19276, SPRINGFIELD, ILLINOIS 62794-9276 • (217) 782-3397
BRUCE RAUNER, GOVERNOR   ALEC MESSINA, DIRECTOR

217/785-1705

CONSTRUCTION PERMIT
NESHAP SOURCE

PERMITTEE

Sterigenics US, LLC
Attn: Laura Hartman, EHS Manager
2015 Spring Road, Suite 650
Oak Brook, Illinois 60523

Application No.: 18060020   I.D. No.: 043110AAC
Applicant's Designation: Date Received: June 11, 2018
Subject: Control of the Backvents of the Sterilization Chambers
Date Issued: June 26, 2018
Location: 7775 Quincy and 830 Midway, Willowbrook, DuPage County

This Permit is hereby granted to the above-designated Permittee to CONSTRUCT emission source(s) and/or air pollution control equipment consisting of control of the backvents of the sterilization chambers, as described in the above-referenced application. This Permit is subject to standard conditions attached hereto and the following special condition(s):

1. Introduction

   a. This permit authorizes control of the existing backvents of the five sterilization chambers (SC-1, SC-2, SC-3, SC-4 and SC-5) at Sterigenic's Willowbrook facilities using the existing control systems that control emissions of ethylene oxide from the vacuum pumps and from aeration.

   b. This permit does not authorize changes to the sterilization chambers or other emission units at the source that would increase their capacity or emissions.

   c. For purposes of this permit, the existing sterilization chambers after their backvents are also connected to control systems are referred to as the "affected units."

2. Existing Requirements

   This permit does alter established requirements for the affected units, (i.e., applicable emission standards and requirements for testing, monitoring, recordkeeping and reporting), as identified in Sections 4.1 and 4.2 of the Clean Air Act Permit Program (CAAPP) permit for the source, Permit No. 95120085, issued June 8, 2015. In particular, the affected units will continue to be subject to federal National Emission Standards for Hazardous Air Pollutants (NESHAP) for Ethylene Oxide Emissions from Sterilization Facilities, 40 CFR 63 Subpart O.

3. Non-applicability Provisions

This permit is issued based on this project not constituting a major modification for purposes of the state rules for Major Stationary Sources Construction and Modification (MSSCAM), 35 IAC Part 203. This is because this project is an emission reduction project that will reduce emissions of volatile organic material.

4. Good Air Pollution Control Practices

At all times, the Permittee shall maintain and operate the affected units and associated air pollution control systems in a manner consistent with good air pollution control practices for minimizing emissions.

5. Notification

The Permittee shall notify the Illinois EPA within 30 days after completion of this project. This notification shall include the date that the backvent on each affected unit is first controlled.

6. Testing

a. Within 180 days of completion of this project, for the affected units, the Permittee shall perform performance testing in accordance with 40 CFR 63.365 and 63.7. The Permittee shall submit applicable notifications and reports for this testing as required by 40 CFR 63.7, 63.360, 63.365 and 63.366.

b. The following USEPA methods and procedures shall be used for testing, unless another USEPA method is approved by the Illinois EPA:

Flowrate	Method 2, 2A, 2B, 2C or 2D
Oxygen (O_2)/Carbon Dioxide (CO_2)	Method 3A or 3B
Moisture	Method 4 or 320
Ethylene Oxide/Propylene Oxide	Method 18 or 320

c. The Permittee shall submit a written test plan to the Illinois EPA for this testing and if a significant change in the procedures for this testing is planned from the procedures followed in the previous test. This plan shall be submitted at least 30 days prior to the actual date of testing and include the following information as a minimum:

i. A description of the planned test procedures.

ii. The person(s) who will be performing sampling and analysis and their experience with similar tests.

iii. The specific conditions under which testing will be performed, including a discussion of why these conditions will be representative of maximum emissions and the means or manner by which the operating parameters for the emission unit and any control equipment will be determined.

iv. The specific determinations of emissions and operation that are intended to be made, including sampling and monitoring locations.

v. The test method(s) that will be used, with the specific analysis method, if the method can be used with different analysis methods.

d. The Permittee shall notify the Illinois EPA prior to conducting these measurements to enable the Illinois EPA to observe testing. Notification for the expected date of testing shall be submitted a minimum of 30 days prior to the expected date. Notification of the actual date and expected time of testing shall be submitted a minimum of 5 working days prior to the actual date of the test. The Illinois EPA may accept shorter advance notice if it does not interfere with the Illinois EPA's ability to observe testing.

e. Copies of the Final Report(s) for these tests shall be submitted to the Illinois EPA within 30 days after the test results are compiled and finalized but no later than 60 days after completion of sampling. The Final Report shall include as a minimum:

i. General information, i.e., date of test, names of testing personnel, and names of Illinois EPA observers.

ii. A summary of results, e.g., VOM emissions, pounds.

iii. A detailed description of operating conditions of the emission unit(s) during testing, including:

A. Process information, i.e., mode(s) of operation, process rate, e.g. fuel or raw material consumption.

B. Control equipment information, i.e., equipment condition and operating parameters during testing.

C. A discussion of any preparatory actions taken, i.e., inspections, maintenance and repair.

iv. Description of test method(s), including description of sampling points, sampling train, analysis equipment, and test schedule.

v. Data and calculations, including copies of all raw data sheets and records of laboratory analyses, sample calculations, and data on equipment calibration.

vi. Conclusions.

f. The Permittee shall retain copies of emission test reports for at least three years beyond the date that an emission test is superseded by a more recent test.

7. Authorization to Operate

The Permittee may operate the affected units with backvents ducted to the existing control systems pursuant to this construction permit until the CAAPP permit for the source is revised to address this project. This condition supersedes Standard Condition 6.

Please note that the Illinois EPA has not acted in this permit on Sterigenic's request for enforceable limits on the operation and emissions of its Willowbrook facilities so that this source is not a major source under relevant air pollution control regulations. The Illinois EPA is processing that request as a separate application.

If you have any questions on this permit, please contact Daniel Rowell at 217/558-4368.

Raymond E. Pilapil
Manager, Permit Section
Bureau of Air

REP:DBR:jlp
DBR
6/26/18

STATE OF ILLINOIS
ENVIRONMENTAL PROTECTION AGENCY
DIVISION OF AIR POLLUTION CONTROL
P. O. BOX 19506
SPRINGFIELD, ILLINOIS 62794-9506

STANDARD CONDITIONS FOR CONSTRUCTION/DEVELOPMENT PERMITS ISSUED BY THE ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

July 1, 1985

The Illinois Environmental Protection Act (Illinois Revised Statutes, Chapter 111-1/2, Section 1039) authorizes the Environmental Protection Agency to impose conditions on permits which it issues.

The following conditions are applicable unless superseded by special condition(s).

1. Unless this permit has been extended or it has been voided by a newly issued permit, this permit will expire one year from the date of issuance, unless a continuous program of construction or development on this project has started by such time.

2. The construction or development covered by this permit shall be done in compliance with applicable provisions of the Illinois Environmental Protection Act, and Regulations adopted by the Illinois Pollution Control Board.

3. There shall be no deviations from the approved plans and specifications unless a written request for modification, along with plans and specifications as required, shall have been submitted to the Agency and a supplemental written permit issued.

4. The Permittee shall allow any duly authorized agent of the Agency upon the presentation of credentials, at reasonable times:

   a. to enter the Permittee's property where actual or potential effluent, emission or noise sources are located or where any activity is to be conducted pursuant to this permit,

   b. to have access to and copy any records required to be kept under the terms and conditions of this permit,

   c. to inspect, including during any hours of operation of equipment constructed or operated under this permit, such equipment and any equipment required to be kept, used, operated, calibrated and maintained under this permit,

   d. to obtain and remove samples of any discharge or emission of pollutants, and

   e. to enter and utilize any photographic, recording, testing, monitoring or other equipment for the purpose of preserving, testing, monitoring, or recording any activity, discharge, or emission authorized by this permit.

5. The issuance of this permit:

   a. shall not be considered as in any manner affecting the title of the premises upon which the permitted facilities are to be located,

   b. does not release the Permittee from any liability for damage to person or property caused by or resulting from the construction, maintenance, or operation of the proposed facilities,

   c. does not release the Permittee from compliance with the other applicable statues and regulations of the United States, of the State of Illinois, or with applicable local laws, ordinances and regulations,

   d. does not take into consideration or attest to the structural stability of any units or parts of the project, and

e. in no manner implies or suggests that the Agency (or its officers, agents or employees) assumes any liability, directly or indirectly, for any loss due to damage, installation, maintenance, or operation of the proposed equipment or facility.

6. a. Unless a joint construction/operation permit has been issued, a permit for operation shall be obtained from the Agency before the equipment covered by this permit is placed into operation.

   b. For purposes of shakedown and testing, unless otherwise specified by a special permit condition, the equipment covered under this permit may be operated for a period not to exceed thirty (30) days.

7. The Agency may file a complaint with the Board for modification, suspension or revocation of a permit:

   a. upon discovery that the permit application contained misrepresentations, misinformation or false statements or that all relevant facts were not disclosed, or

   b. upon finding that any standard or special conditions have been violated, or

   c. upon any violations of the Environmental Protection Act or any regulation effective thereunder as a result of the construction or development authorized by this permit.

From: "Armitage, Julie" <Julie.Armitage@Illinois.gov>
Date: September 7, 2018 at 6:34:23 PM CDT
To: "Hoffman, Kathy" <KHoffman@sterigenics.com>
Cc: "Mattison, Kevin" <Kevin.Mattison@Illinois.gov>

By this email, at your request, and to facilitate the shared goal of expedited emissions testing, the Bureau of Air provides notice that it is waiving the timeframe for test plan submittal (30 days prior to testing – condition 6c) and the timeframe for notification of expected and actual test dates (30 and 5 days, respectively – condition 6d) under construction permit No. 18060020 issued June 26, 2018. Also, the Bureau provides notice that, after review and consultation with the USEPA, it is accepting the protocol received August 28, 2018, and supplemented September 7, 2018, conditioned upon the testing scheduled for September 8th, being performed in accordance with USEPA reference methods and supported by a detailed final report that evidences the validity of the test, adherence to reference methods, and compliance with all relevant permit terms.

Should you have comments or questions regarding this matter, pleased direct them to my attention or to that of Kevin Mattison of my staff who will be present for the September 8th testing.

Sterigenics.
A Sotera Health company

September 7, 2018 **Sent via email**

Julie Armitage
Illinois Environmental Protection Agency
Bureau of Air
1021 North Grand Avenue East
Springfield, Illinois 62702

Kevin Mattison
Illinois Environmental Protection Agency
Bureau of Air / Compliance Section
9511 Harrison Street
Des Plaines, IL 60016

Re: Waiver Request of Construction Permit Test Notification Requirements, and Additional Test Protocol Information for Sterigenics Willowbrook I and II Facilities
Facility I.D. No: 043110AAC

Ms. Armitage and Mr. Mattison:

In our recent conversations, we discussed our shared interest in conducting performance testing of the Willowbrook facilities' control equipment as quickly as possible after recently tying in our sterilization chamber backvents into each facility's existing emission control equipment. This letter formally requests IEPA's waiver of the 30 and 5 day performance test notification requirements found in the project's Construction Permit (Application No. 18060020), at Conditions 6 c. and 6 d. If the waiver of notification requirements is granted, then we would plan to commence performance testing beginning in the morning on Saturday, September 8 at approximately 7:00am at Willowbrook I, 7775 Quincy Street. Testing at Willowbrook II will commence at approximately noon.

This letter also provides additional information regarding the previously submitted test protocol we submitted in our last letter. Based on guidance from Mr. Mattison, this information will serve to provide further details about the planned test procedures and how test results are to be generated. With this additional information, we also request that IEPA grant its approval of the updated test protocol.

Please contact me to further discuss this matter. You can reach me at 630-928-1771 or email: kwagner@sterigenics.com.

Regards,

Kevin Wagner
Director, EH&S

Enclosures:

Sterigenics International LLC
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Test Protocol Addendum for both Willowbrook I and Willowbrook II

2.0 EQUIPMENT

Process parameters for both AAT emission control devices will be measured prior to testing. One measurement of the scrubber would be representative of scrubber conditions throughout the testing. Based on the total volume of the scrubber liquor, it isn't anticipated that an appreciable change in liquor level or pH will occur over the course of testing. In accordance with the site's air permit the scrubber tank level will be measured along with the liquor pH.

3.0 TESTING

Once a sterilization chamber cycle ends, our process requires the chamber door to be partially opened for 15 minutes which vents the EO in the chamber to reduce levels in the chamber and exposure to employees. The 15-minute duration ensures the highest concentration of EO is removed from the chamber prior to unloading the product. During this venting, EO exhausts thru the backvent and to the AAT scrubber. In accordance with our procedures, workers are not allowed to enter or unload the chamber until the 15-minute time period has passed. Once the 15-minutes has passed, the product is unloaded to the aeration room.

The Willowbrook facility utilizes different sterilization cycles based on FDA validated cycles. The EO concentration in the chamber prior to the backvent phase can vary. Therefore, the higher ending concentrations will represent the highest amount of EO exhausted thru the backvents to the AAT scrubber.

In order to meet Condition 6 of the Construction Permit, each test run will be completed on the backvents using freshly sterilized product from one chamber for a 15-minute duration, for a total of three test runs at each facility. The emission testing will use chambers with higher ending EO concentrations for testing. Each test interval will test the first 15-minutes the backvent is opened and exhausted to the scrubber. Once the 15 minutes ends, product will be unloaded from the chamber and placed into the aeration rooms which are continuously vented to the same AAT scrubber throughout the test.

Recording data

Sterigenics will record process data during the performance testing to identify which chamber was utilized and the sterilization cycle number for each test. This process data will be summarized in a table which will be provided in the final report. In addition to the process data collection, Sterigenics will record pH and scrubber liquor level of the AAT scrubber prior to the test. This information will also be furnished with the process data in the final report. Due to the AAT scrubber size and design, these parameters do not change significantly during the course of a day which exceeds the performance testing duration.

SECTION 5.0 TEST METHOD REFERENCE

The protocol indicated the CO2/O2 will not be measured, rather the stack will be assumed to be ambient air. The assumed molecular weight of the stack gas will be 29.

5.2 VOLUMETRIC FLOW MEASUREMENT

Method 2C will be utilized to test volumetric flow. The sample port used for the Method 18 inlet and outlet will be used for Method 2C. Please see attached Figure 1 for a drawing of the test locations in accordance with USEPA Method 1 or 1a. The absence of cyclonic flow will be verified during the test program.

5.4 SAMPLE TRANSPORT

In addition to the description of the sample transport in the protocol, the lines used for testing will be heated above 110°C. Source gas will be pumped to the GC with a response time of 5-10 seconds.

5.7 CALIBRATIONS

Calibration will be performed in triplicate prior to and at the end of each test day. Limit of detection will be determined.

6.0 TEST SCENARIO

As discussed above, backvent testing will be performed during normal process load conditions, with freshly sterilized product in the sterilization chambers. Three test runs will be conducted in series to verify the performance of the emission-control system.

Sterilization chamber cycles can range from 8 – 12 hours. Sterigenics will schedule three chambers to end the sterilization cycle to allow for the three test runs to run consecutively, however, due to the range in cycle time, it may be necessary to wait for the chamber cycle to end prior to beginning the subsequent testing.

The sample testing will begin at approximately 7:00 am on Saturday, September 8, 2018. The equipment will be set up Friday evening. Calibration of the chromatograph system will be completed prior to beginning the test at Willowbrook 1 and then again prior to beginning the test at Willowbrook 2.

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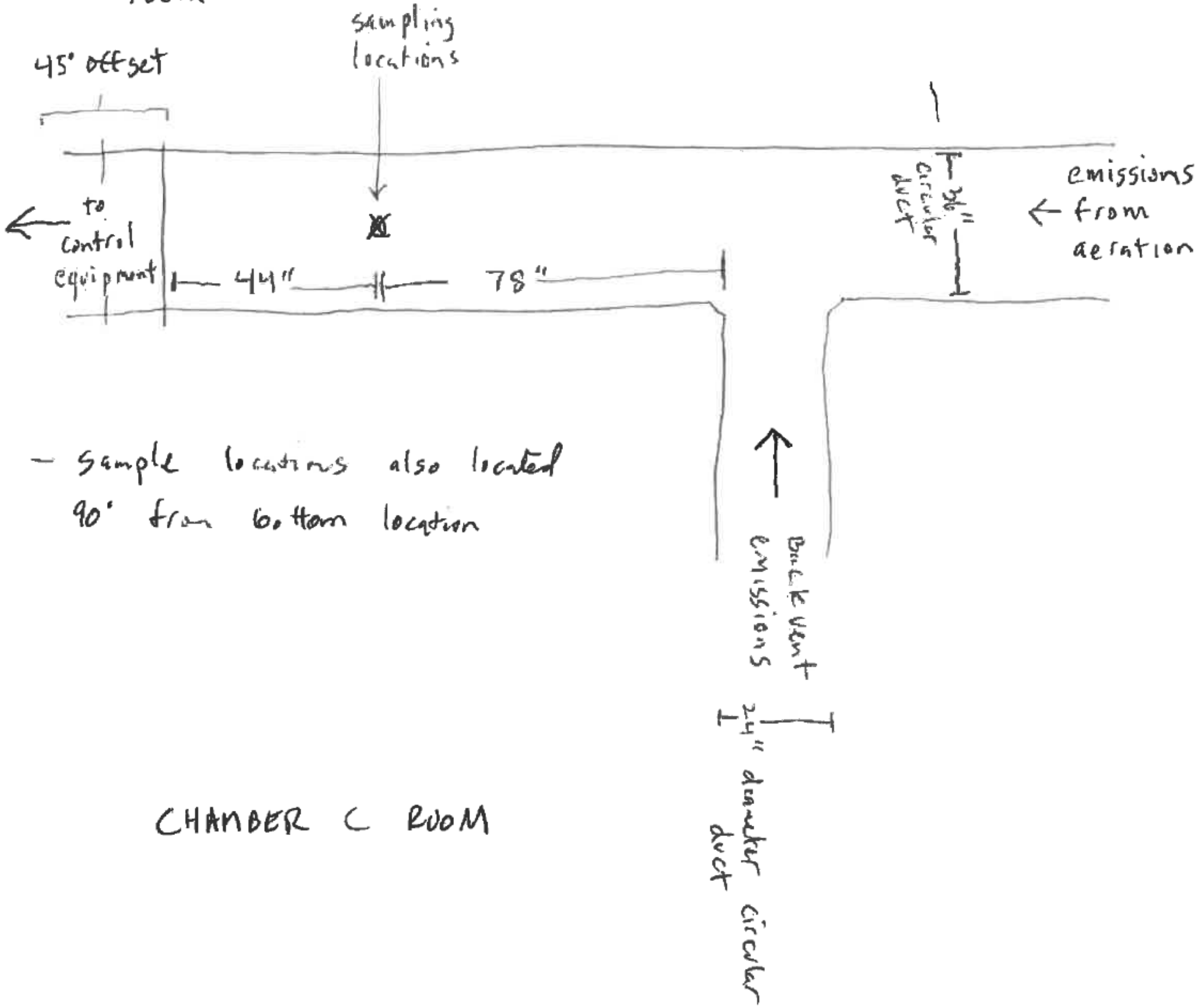
Test Scenario Time Line

	Sequence for each facility	Method/Reference
	Sample port locations established	Method 1
	3-point calibration performed in triplicate.	Method 18
	Obtain meteorological data for sampling time. Conduct calculation based on Method 4.	Method 4
SAMPLE 1	Flow traverse of inlet and outlet conducted to establish measurement centroid, confirm absence of cyclonic flow.	Method 2
7:00 am	Chamber door opened, actuator switch activates backvent	N/A
	First sample initiated	Method 18
	Samples at inlet and outlet taken approximately every 1-minute for a total of 15-minutes	Method 18
	Flow monitoring sampled approximately every 1-minute.	
	Recovery study performed	Method 18
Each sample run will follow the same steps as sample 1		
End of 3 samples	Post calibration	

WB I INLET TEST LOCATION

- view is looking above at ceiling of chamber C room

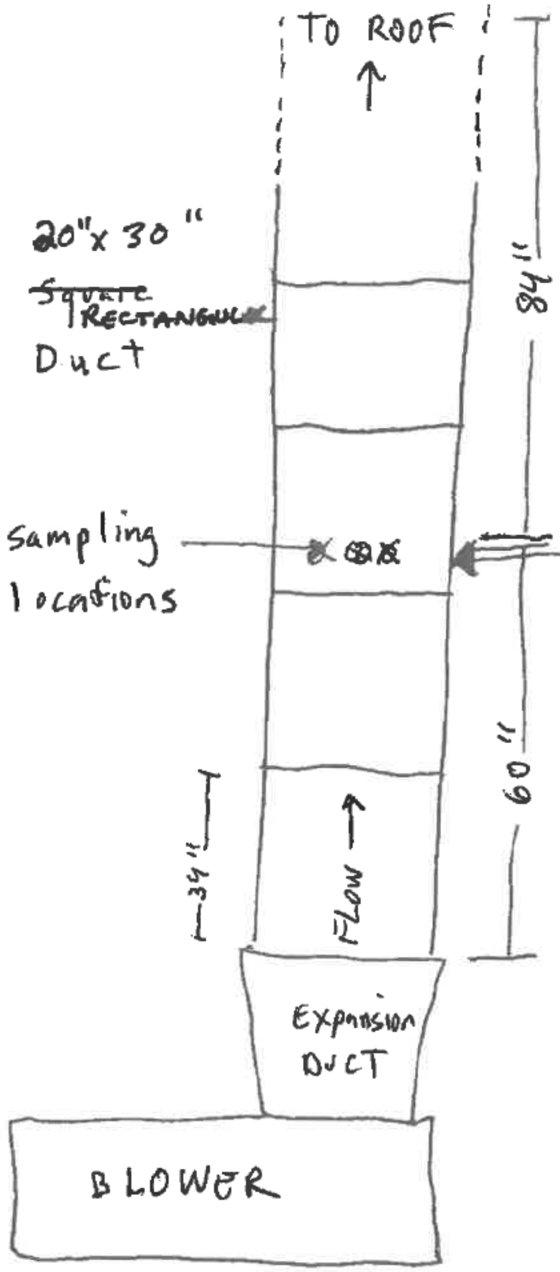


- sample locations also located 90° from bottom location

WB I OUTLET TEST LOCATION

- Main stretch of ducting is 20" x 30" ~~square~~ rectangular duct
- Sample points are located 84" ~~to~~ below top-most disturbance and 60" above lowest disturbance

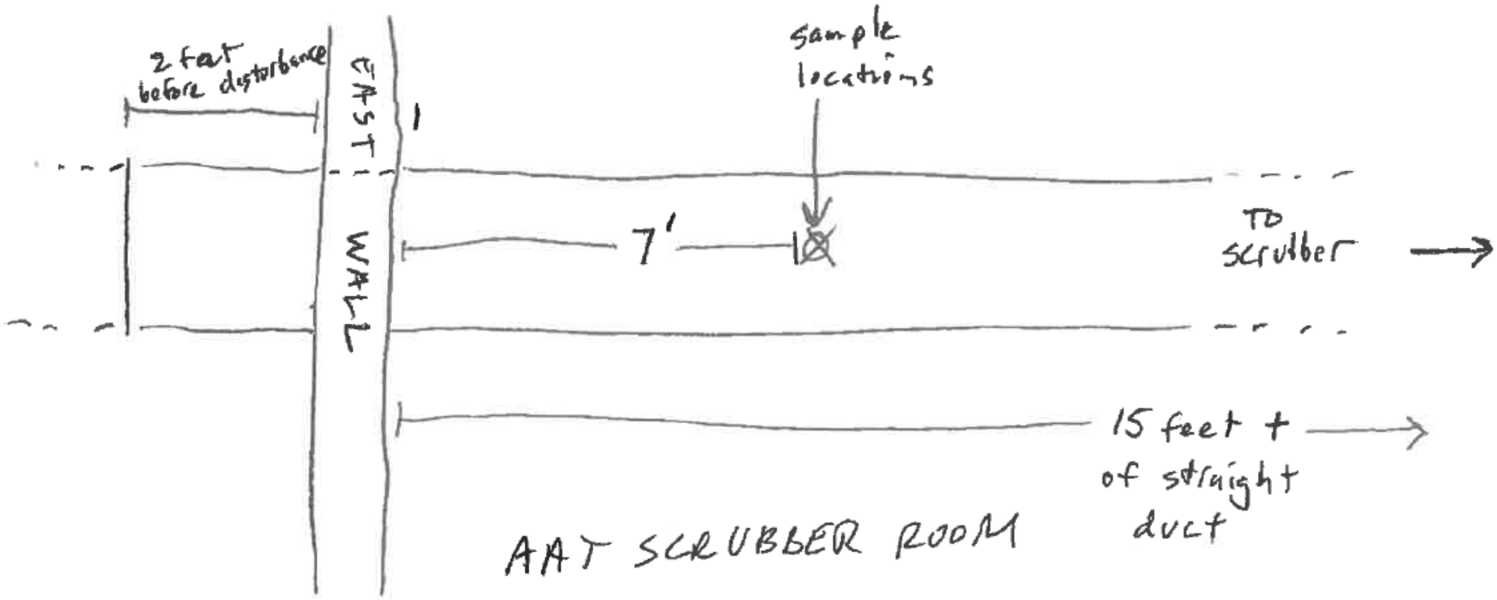
Sample locations also on side of duct



AAT DRYBED ROOM

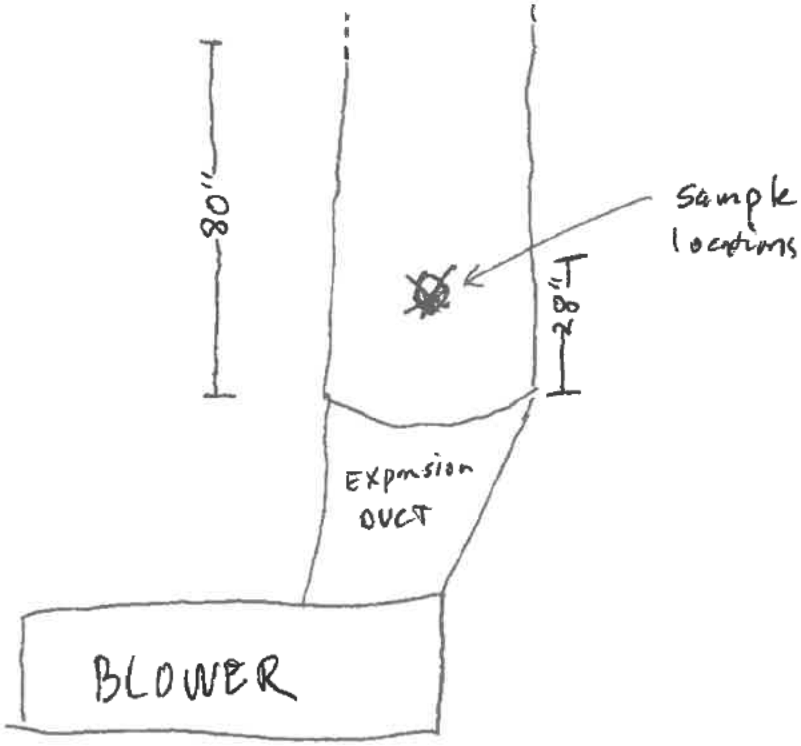
WB II INLET TEST LOCATION

- View is looking up at ceiling of AAT Scrubber Room



- sample locations also located 90' from bottom location.

WB II OUTLET TEST LOCATION



- 28" diameter circular duct
- sample locations also located 90° from front location

AAT DRYBED ROOM

* sample point will be located in straight run. Verified to meet Method prior to test.

TEST PROTOCOL FOR
AIR POLLUTION SOURCE TESTING
OF AN ETHYLENE OXIDE EMISSION-CONTROL SYSTEM
OPERATED BY STERIGENICS US, LLC.
AT ITS WILLOWBROOK I, ILLINOIS FACILITY

Submitted to:

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY
1021 North Grand Avenue East
Springfield, Illinois 62794

Submitted by:

STERIGENICS US, LLC.
7775 South Quincy Street
Willowbrook, Illinois 60521

I.D. Number 043110AAC

Prepared by:

ECSI, INC.
PO Box 1498
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Prepared on:

August 24, 2018

ECSi

CONTACT SUMMARY

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TEST DATE

September 20-21, 2018

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TABLE OF CONTENTS

1.0 INTRODUCTION

ECSi, Inc. proposes to conduct air pollution source testing of the ethylene oxide (EtO) emission control system operated by Sterigenics US, LLC. at their Willowbrook I facility, located at 7775 S. Quincy Street. The device to be tested is the two stage AAT Safe Cell packed tower scrubber/dry bed reactor emission-control system, which is used to control emissions from fourteen sterilizer backvents and three aeration rooms. The purpose of the testing program will be to demonstrate compliance with backvent emission control requirements and the conditions established in the Air Quality Permit granted to Sterigenics by the Illinois Environmental Protection Agency (IEPA).

We have specialized exclusively in the performance of ethylene oxide source testing and leak testing since 1992, and are the nationally recognized expert in the field. When the current ethylene oxide emissions regulations were being implemented, we worked closely with the California Air Resources Board (CARB) and USEPA to help develop the currently used testing methodology.

2.0 EQUIPMENT

At Willowbrook I, sterilizer backvent emissions are controlled by:

- One two-stage Advanced Air Technologies Safe Cell emission-control system, comprised of a packed-tower chemical scrubber (SC1), equipped with a packed reaction/interface column, a scrubber fluid recirculation system, and a scrubber fluid reaction/storage tank, and a dry bed reactor/scrubber (SC2), comprised of a bank of solid-bed reaction vessels, connected in parallel, installed downstream of SC1 and upstream of a dedicated blower exhaust system.

3.0 TESTING

EtO source testing will be conducted in accordance with the procedures outlined in USEPA CFR40, Part 63.365, using USEPA Method 18 as specified. EtO emissions monitoring will be conducted simultaneously at the inlet and outlet of the Safe Cell System (the inlet of SC1 and the outlet of SC2) during the entire duration of the backvent phase of one of the fourteen sterilizers. A total of three backvent-phase test runs will be performed.

During the backvent phase, EtO emissions at the inlet and the outlet of the Safe Cell System will be determined using direct source sample injection into a gas chromatograph (GC). All testing will be conducted during normal process load conditions. All backvent testing will be performed with freshly sterilized product in the sterilizer. The testing program will be conducted in accordance with the procedures outlined in the following sections.

4.0 RULE/COMPLIANCE REQUIREMENTS

The EtO gas-sterilization system at the Willowbrook I facility is being tested to demonstrate compliance with EPA requirements, as specified in the IEPA Air Quality Permit. The following requirements must be met:

- The sterilizer backvent phase emissions must be vented to control equipment with an EtO emission-reduction efficiency of at least 99 % by weight.

Testing is required to demonstrate compliance with these requirements. Source testing of the emission-control system is required initially, and may be required periodically thereafter.

5.0 TEST METHOD REFERENCE

5.1 INTRODUCTION

EtO source testing will be conducted in accordance with the procedures outlined in USEPA CFR40, Part 63.365, using USEPA Method 18 as specified. EtO emissions monitoring will be conducted simultaneously at the inlet and outlet of the Safe Cell System during the entire duration of the backvent phase of one of the fourteen sterilizers. A total of three backvent-phase test runs will be performed.

During the backvent phase, EtO emissions at the inlet and the outlet of the Safe Cell System will be determined using direct source sample injection into a gas chromatograph (GC). All testing will be conducted during normal process load conditions. All backvent testing will be performed with freshly sterilized product in the sterilizer. The testing program will be conducted in accordance with the procedures outlined in the following sections.

Operation and documentation of process conditions will be performed by personnel from Sterigenics, Inc. using existing monitoring instruments installed by the manufacturer on the equipment to be tested. In accordance with the procedures established in USEPA CFR40, Part 63, Subpart O, scrubber liquor level will be recorded.

5.2 VOLUMETRIC FLOW MEASUREMENT

Exhaust gas flow at the outlet of SC2 will be determined by 40 CFR 60, Appendix A, Method 2C, using a standard pitot tube and an inclined-oil manometer. Sampling ports will be located in accordance with 40 CFR 60, Appendix A, Method 1. The test ports will be located far enough from any flow disturbances to permit accurate flow measurement.

Temperature measurements will be obtained from a type K thermocouple and thermometer attached to the sampling probe. Exhaust gas composition will be assumed to be >99% ambient air. Water vapor will be negligible and, based on previous test data, a default ambient value of 3 percent will be used for determination of exhaust gas composition and flow calculations.

5.3 CONTROL EFFICIENCY AND MASS EMISSIONS MEASUREMENT

The EtO concentration at the inlet and outlet of the Safe Cell System will be measured simultaneously following the procedures delineated in USEPA CFR40, Part 63.365. During backvent, vented gas will be analyzed by an SRI, Model 8610, portable gas chromatograph (GC), equipped with the following: dual, heated sample loops and injectors; dual columns; and dual detectors. A flame ionization detector (FID) will be used to quantify emissions at the emission-control device inlet, and a photoionization detector (PID) will be used to quantify emissions at the emission-control device outlet.

5.4 SAMPLE TRANSPORT

Source gas will be pumped to the GC at approximately 500-1000 cubic centimeters per minute (cc/min) from the sampling ports through two lengths of Teflon® sample line, each with a nominal volume of approximately 75 cubic centimeters (cc) and an outer diameter of 0.25 inch. At the outlet of SC2 the sampling ports will be located in the exhaust stack.

5.5 GC INJECTION

Source-gas samples will then be injected into the GC which will be equipped with two heated sampling loops, each containing a volume of approximately 2cc and maintained at 100 degrees Celsius (C). Injections will occur at approximately one-minute intervals during the sterilization chamber backvent phase. Helium will be the carrier gas for both FID and PID.

5.6 GC CONDITIONS

The packed columns for the GC will both be operated at 85 degrees C. The columns will be stainless steel, 6 feet long, 0.125 inch outer diameter, packed with 1 percent SP-1000 on 60/80 mesh Carbopack B.

Any unused sample gas will be vented from the GC system back to the inlet of the scrubber.

5.7 CALIBRATION STANDARDS

The FID used at the inlet will be calibrated for part-per-million-by-volume (ppmv)-level analyses using gas proportions similar to the following:

1) 100 ppmv EtO, balance nitrogen
2) 50 ppmv EtO, balance nitrogen (audit gas)
3) 10 ppmv EtO, balance nitrogen
4) 1 ppmv EtO, balance nitrogen

The PID used at the outlet will be calibrated for ppmv-level analyses using gas proportions similar to the following:

1) 100 ppmv EtO, balance nitrogen
2) 50 ppmv EtO, balance nitrogen (audit gas)
3) 10 ppmv EtO, balance nitrogen
4) 1 ppmv EtO, balance nitrogen

Each of these calibration standards will be in a separate, certified manufacturer's cylinder. Copies of the calibration gas laboratory certificates will be included with the final report.

5.8 SAMPLING DURATION

Backvent EtO measurements will be taken for the entire duration of the backvent phase, which will be 15 minutes. This will encompass a total sampling duration of 15 minutes for each backvent phase test run.

5.9 CONTROL-EFFICIENCY/MASS-EMISSIONS CALCULATIONS

Control efficiency of EtO will be calculated for the backvent phase. Control efficiency will be calculated for each data point which will be produced at each injection interval. The time-weighted-average (TWA) EtO control efficiency will be calculated using these results. Results of the control-efficiency testing will be summarized in the final report.

Mass emissions of EtO will be calculated using the following equation:

MassRate = (VolFlow)(MolWt)(ppmv EtO/10^6)/(MolVol)

Where:

MassRate = EtO mass flow rate, pounds per minute

VolFlow = Corrected volumetric flow rate, standard cubic feet per minute at 68 degrees F

MolWt =	44.05 pounds EtO per pound mole
ppmv EtO =	EtO concentration, parts per million by volume
10^6 =	Conversion factor, ppmv per "cubic foot per cubic foot"
MolVol =	385.32 cubic feet per pound mole at one atmosphere and 68 degrees F

Mass emissions of EtO will be calculated for backvent. The results will be summarized in the final report.

6.0 TEST SCENARIO

Backvent testing will be performed during normal process load conditions, with freshly sterilized product in the sterilizer. Three test runs will be conducted in series to verify the performance of the emission-control system. The testing schedule will be as follows:

- Equipment setup and gas chromatograph calibration.
- Backvent Test Run #1 is performed with freshly sterilized product in one of the fourteen sterilizers. Sampling is performed at the inlet and outlet of the Safe Cell System.
- Backvent Test Run #2 is performed with freshly sterilized product in one of the fourteen sterilizers. Sampling is performed at the inlet and outlet of the Safe Cell System.
- Backvent Test Run #3 is performed with freshly sterilized product in one of the fourteen sterilizers. Sampling is performed at the inlet and outlet of the Safe Cell System.
- Post-calibration check performed and equipment breakdown.

7.0 QA/QC

7.1 FIELD TESTING QUALITY ASSURANCE

At the beginning of the test, the sampling system will be leak checked at a vacuum of 15 inches of mercury. The sampling system will be considered leak free when the flow indicated by the rotameters falls to zero.

At the beginning of the test, a system blank will be analyzed to ensure that the sampling system is free of EtO. Ambient air will be introduced at the end of the heated sampling line and drawn through the sampling system line to the GC for analysis. The resulting chromatogram also will provide a background level for non-EtO components (i.e. ambient air, carbon dioxide, water vapor) which are present in the source gas stream due to the ambient dilution air which is drawn into the emission-control device. This chromatogram, designated AMB, will be included with the calibration data in the final report.

7.2 CALIBRATION PROCEDURES

The GC system will be calibrated at the beginning and conclusion of each day's testing. Using the Peaksimple II analytical software, a point-to-point calibration curve will be constructed for each detector. A gas cylinder of similar composition as the calibration gases, but certified by a separate supplier, will be used to verify calibration gas composition and GC performance.

All calibration gases and support gases used will be of the highest purity and quality available. A copy of the laboratory certification for each calibration gas will be included in the final report.

8.0 FINAL TEST REPORT DESCRIPTION

The test results will be summarized in a written report. This report will be submitted to the IEPA no later than sixty days after the conclusion of the field testing. It will include results for EtO control efficiency of the emission-control device and mass emissions of EtO to the atmosphere from the emission-control device outlet. The report will contain:

- Summary tables with comparisons of the test results to rule limits;
- Copies of all intermediate data tables and calculation worksheets;
- Copies of all GC chromatograms from calibration runs and sample injections; and
- Laboratory calibration certificates for all calibration and audit gases and all applicable measurement instruments such as pitot tubes and thermocouples.